

6. HOUSING

The housing sector is employment intensive; it generates employment during its construction period and, during its life for maintenance purpose. The United Nations Centre for Human Settlements (UNCHS) uses a broader term "Settlement conditions" because it extends to all those components of the physical environment with which an individual or a community comes into contact and which are used on a regular basis for the whole range of human activities - the individual dwelling and its related services, the dwelling's immediate surroundings, community facilities, transportation and communications network and so on.

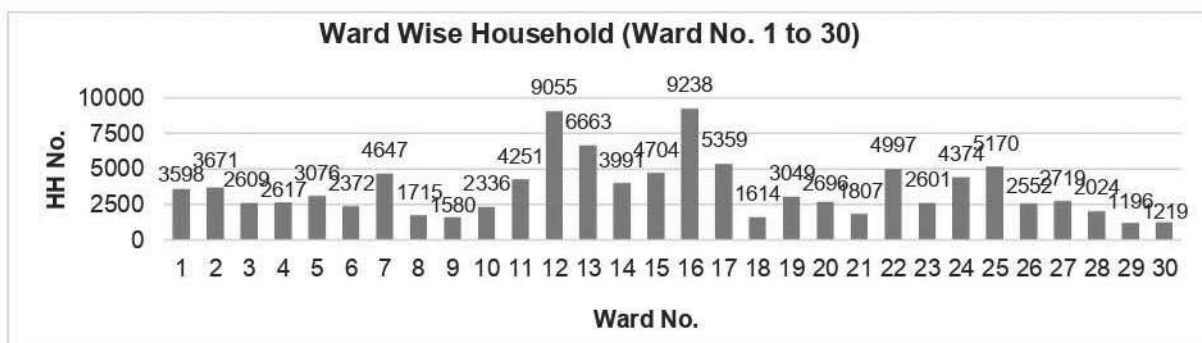
This section of the report reviews the housing profile in the project area. Census 2011 housing data had used to analyse the profile. Analysis of the Guwahati urban area includes GMC area (60 wards), Narengi (OG) area, 8 Census Towns namely Azara, Amin Gaon, Garal, Jalah, Kahi Kuchi, Bamun Sualkuchi, Changsari, Dharapur and 4 wards of North Guwahati. In addition, number of household data of other rural centers falling within the project area is available but rest of the housing parameters are available only for GMC, North Guwahati, OG and Census Town area; hence, some housing parameters of rural area were analysed considering percentage share with Kamrup Metro rural.

6.1 Existing Housing Scenario

In today's context, perhaps the most important issue for urban dwellers is to find an appropriate place to live. It is observed that the price of all kinds of housing have been increasing exorbitantly, which indicate that the investment in housing sector is unable to match pace with the increasing demand for housing. Rapid urbanization and rural to urban migration have led to a substantial shortage of housing in the region. The direct result of this is the concentration of informal settlements in the city. Given that the shortage in housing is concentrated at the bottom of the pyramid, the sector can play an important role in the socio-economic development. Moreover, with the rapid urbanization and significant increase in the housing demand, housing sector is the engine of immense potential of giving a push to the economy because of its link with employment generation and livelihood. Therefore, provision of housing can make a significant difference in income of families, both in rural and urban areas. The number of households in GMPA for year 2011 is given

Table 6-1: Guwahati Municipal Corporation area

Ward No.	Population (2011)	No. of Households	Housing size	Ward No.	Population (2011)	No. of Households	Housing size
1	3598	16692	4.6	31	1753	7387	4.2
2	3671	16613	4.5	32	2381	10332	4.3
3	2609	11106	4.3	33	1919	8368	4.4
4	2617	10731	4.1	34	2591	11088	4.3
5	3076	12526	4.1	35	2738	11012	4.0
6	2372	10171	4.3	36	3321	13966	4.2
7	4647	20366	4.4	37	3924	15854	4.0
8	1715	7593	4.4	38	2200	8589	3.9
9	1580	6746	4.3	39	2874	11574	4.0
10	2336	10216	4.4	40	2022	7782	3.8
11	4251	18514	4.4	41	5365	21514	4.0
12	9055	39995	4.4	42	4192	16649	4.0
13	6663	29041	4.4	43	2214	9295	4.2
14	3991	17629	4.4	44	3883	15073	3.9
15	4704	19228	4.1	45	3066	12537	4.1
16	9238	39056	4.2	46	6754	28309	4.2
17	5359	21292	4.0	47	2510	9772	3.9
18	1614	7431	4.6	48	3194	12686	4.0
19	3049	14957	4.9	49	7113	30124	4.2
20	2696	11887	4.4	50	3691	14084	3.8
21	1807	7718	4.3	51	7550	30057	4.0
22	4997	21169	4.2	52	2112	9000	4.3
23	2601	10837	4.2	53	3917	14890	3.8
24	4374	17830	4.1	54	5982	24226	4.0
25	5170	20707	4.0	55	3507	13670	3.9
26	2552	10431	4.1	56	6337	26625	4.2
27	2719	12008	4.4	57	3336	13359	4.0
28	2024	9828	4.9	58	8165	31876	3.9
29	1196	6988	5.8	59	6846	25709	3.8
30	1219	5688	4.7	60	6761	26951	4.0
Total	Population	957352	Household No.	229718	HH Size	4.2	



(Source: Compiled by Consultant)

Figure 6-1: Ward wise Household No. (Ward no. 1 to 30) in year 2011

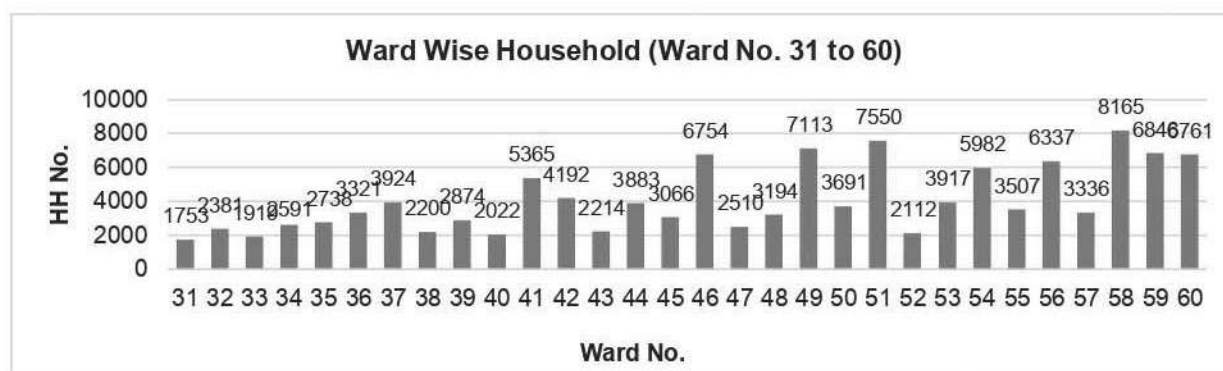


Figure 6-2: Ward wise Household data (Ward No. 31 to 60) in year 2011

Table 6.1 depicts the ward wise population and total number of households in Guwahati Municipal Corporation area. The maximum number of households are in Ward no. 16 followed by Ward no. 12 and 58. The minimum number of households are in ward no. 29. Based on the population and households, the housing size is calculated. The overall housing size is 4.2 which is calculated from the ward wise total population and total number of households. The maximum housing size observed in Ward no. 29 which is 5.8. The minimum housing size is 3.8 which is in ward numbers 40,50,53,59.

Table 6-2: Existing households in Outgrowth and Census Towns

Name of the OG/CT/ TC	Population 2011	No. of HHs	Housing Size
Narengi (OG)	4982	1051	4.7
Changsari (CT)	5354	1181	4.5
Jalah (CT)	6468	1379	4.7
Amin Gaon (CT)	8855	2037	4.3
Bamun Sualkuchi (CT)	7628	1732	4.4
Kahi Kuchi (CT)	9917	2522	3.9
Garal (CT)	4400	973	4.5
Azara (CT)	8780	2002	4.4
Dharapur (CT)	8095	1796	4.5
North Guwahati (Ward-1)	1233	273	4.5
North Guwahati (Ward-2)	2665	576	4.6
North Guwahati (Ward-3)	3123	708	4.4
North Guwahati (Ward-4)	3307	737	4.5
Total	14731	3294	4.4

(Source: Compiled by Consultant)

The table 6.2 describes the existing households in North Guwahati, Outgrowth and Census Towns area as per Census 2011 and from this the housing size is calculated which turns out to be 4.4 on an average. Housing size observed maximum in Kahi Kuchi (CT) which is 3.9 followed by Amin Gaon (CT) which is 4.3.

Table 6-3 Existing households in rural area

Name	Population 2011	No. Of Household 2011	Housing size
Rural Housing within GMPA	1,13,381	24,540	4.6

(Source: Compiled by Consultant)

The population in GIS based Guwahati MPA's rural area is 113381 and the total number of households are 24540. The Household size observed in this region is 4.6

6.1.1 Households in GMPA

In GMPA, the area wise household details are as mentioned below

Table 6-4 Existing households in Guwahati Master Plan Area for 2045

Sr. No.	Name of Area	Population	No. Of HHs	Percentage	HH size
1	GMC + OG (60 wards)	962334	230769	84%	4.2
2	8 Census Towns	59497	13622	5%	4.4
3	North Guwahati (4 wards)	10328	2294	1%	4.5
4	76 Rural Villages	113381	24540	10%	4.6
Total for GMPA		1141699	271225	100%	4.4

(Source: Census of India 2011, Compiled by Consultant)

The table 6-4 indicates total population in GMPA is 11,41,699 and the number of households are 2,71,225 which further leads to the overall household size 4.4. The maximum population is in GMC + OG area which is 962334 and contributes 84% of total GMPA. The lesser number of households observed in North Guwahati area which is having only 1% of the total household.

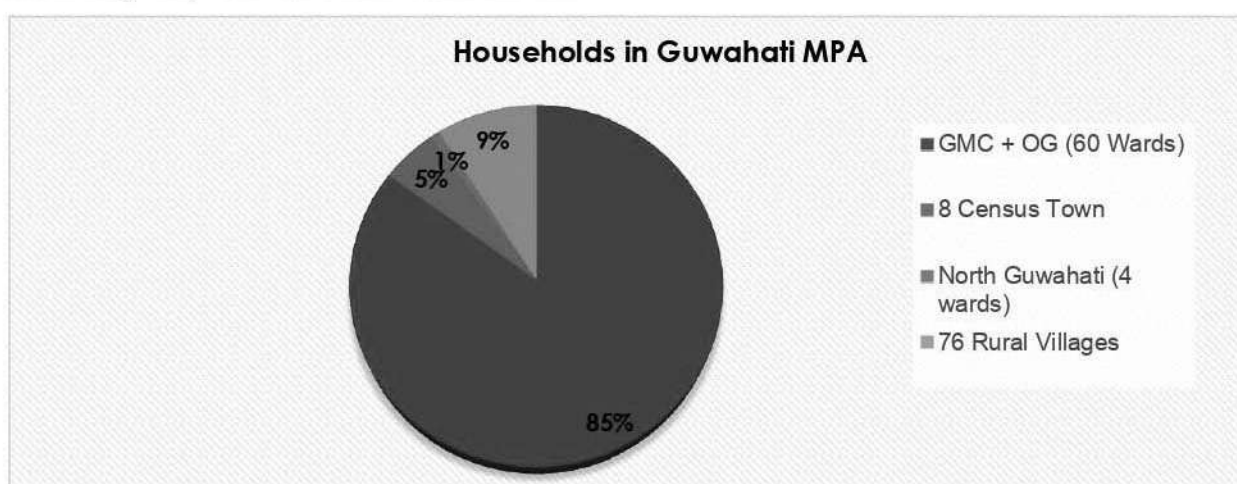


Figure 6-3: Existing Household in Guwahati Master Plan Area

6.1.2 Size of The Household

The 1991 Census reveals that more than half of the households in the region were medium sized with an average member of 3 to 5. According to census 2011 the medium sized households (4-5) is predominant because of the increasing trend towards nuclear households. Since the trend in nuclear households and rapid urbanisation are at higher rate, there will be considerable pressure on housing in coming future. The overall household size of the Guwahati Planning Area is 4.4. HH size is lowest in GMC and OG area which is 4.1 and highest in Village areas (4.6).

6.1.3 Housing Typology

The 'Housing Typology' is the complex nature of regional contexts as places to formulate human habitation. Investigating the interdependencies evolving between a building's entity and its territory can contribute in the future to development of region. Permanent houses are those with wall and roof made of permanent materials. Wall can be made of G.I., Stone packed with Mortar, Stone not packed with Mortar, Metal, Asbestos sheets, burnt bricks, Stone or Concrete. Roof can be made of Hand-made tiles, Machine made tiles, Slate, G.I., Metal, Asbestos sheets, Brick, Stone, or Concrete. Semi-permanent houses are those in which either wall or roof is made of permanent material and other is made of temporary material. Temporary houses are the ones with wall and roof made of temporary material. Wall can be made of Grass, Thatch, Bamboo etc., Plastic, Polythene, Mud, Unburnt brick, or Wood. Roof can be made of Grass, Thatch, Bamboo, Wood, Mud, Plastic or Polythene. Table 6-5 reveals the number of households living in permanent, semi-permanent and temporary houses within the GMPA. Out of 271225 households, 73% are permanent, 25% are semi-permanent and 2% are temporary houses.

Table 6-5: Distribution of households living in permanent, semi-permanent and temporary houses

Particular		Permanent	%	Semi-permanent	%	Temporary	%
Urban	GMC + OG	1,75,384	76%	53,077	23%	2,308	1%
	8 Census Towns	8718	64%	4,768	35%	136	1%
	North Guwahati (4 Wards)	1,514	66%	757	33%	23	1%
Rural	76 Rural Villages	8589	34%	12025	49%	3926	16%
Total		1,97,994	73%	67,806	25%	5,425	2%

(Source: District Census Handbook, Guwahati, Village & Town wise Primary Census Abstract 2011)

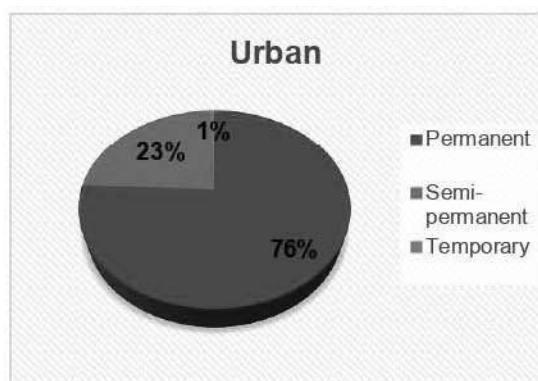


Figure 6-5 Urban Housing Typology in GMPA

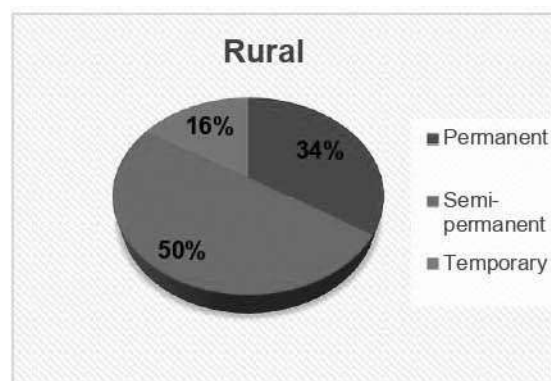


Figure 6-4 Rural Housing Typology in GMPA

Table 6.5 indicates that in urban area around 76% are permanent households, around 23% are semi-permanent and approx.1% of dwelling units are temporary units in Guwahati urban area. In rural areas (figure 6-5), the percentage of permanent housing is 34%, semi-permanent housing is 50% and temporary housing units are around 16%. This clearly indicates that focusing the housing development in rural areas is of importance in order to provide basic need of the people.

6.1.4 Housing Condition

Housing Condition includes the study of condition of housing based on type of structure i.e., permanent/ semi- permanent, physical infrastructure, mass space relationship, condition of the material used for walls and floors etc. It is important to be studied because it indicates the efficiency and sustainability of the housing stock, whether the houses are liveable or not. Based on the above said parameters, the condition of houses has been segregated and the analysis is done as good, liveable, and dilapidated houses.

Table 6-6 Housing Conditions in GMC+ OG Area

Area	Residence (%)				Residence-cum-other use (%)			
	Total	Good	Livable	Dilapidated	Total	Good	Livable	Dilapidated
Assam	6,272,151	33%	56%	11%	95,144	30%	62%	8%
Kamrup Metro	2,85,148	47%	45%	9%	1,041	41%	52%	7%
GMC + OG	2,27,719	70%	26%	4%	3793	54%	41%	5%

(Source: Census of India 2011)

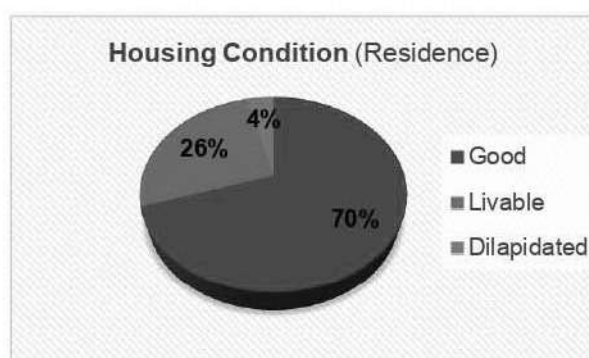


Figure 6-7 Residential housing condition

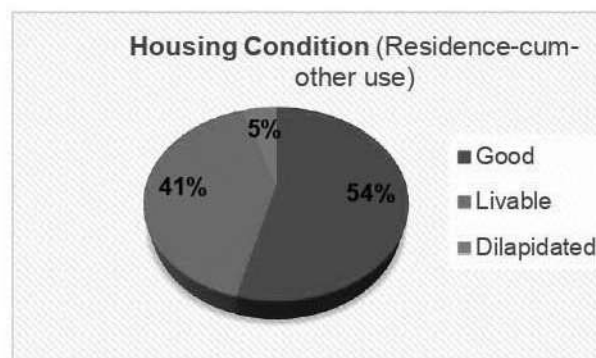


Figure 6-6 Residential cum other use housing condition

Table 6-7: Slum Housing Condition

Area	Residence (%)				Residence-cum-other use (%)			
	Total	Good	Livable	Dilapidated	Total	Good	Livable	Dilapidated
Assam	46,911	44%	45%	11%	1,128	52%	44%	4%
GMC+OG	6,901	55%	37%	8%	55	29%	49%	22%

(Source: Census of India 2011)

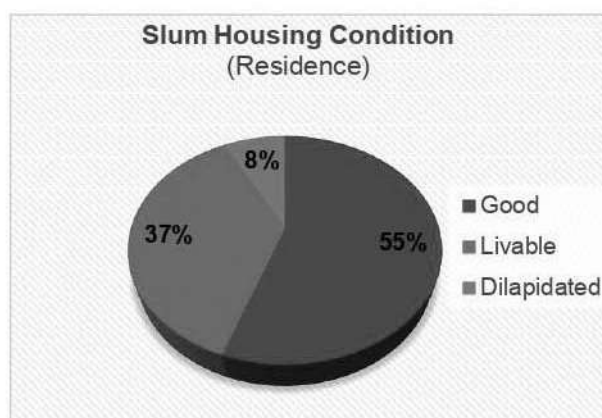


Figure 6-8: Slum Housing condition (residential)

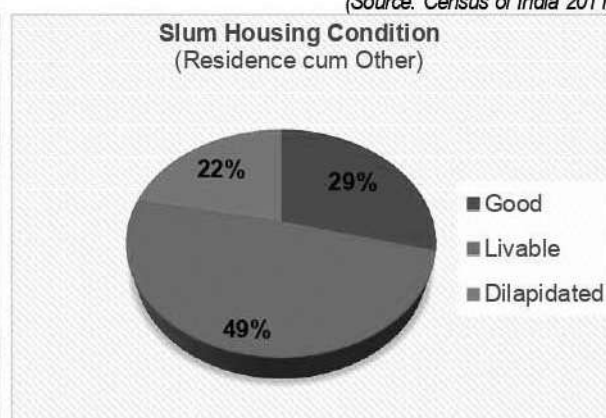


Figure 6-9: Slum Housing condition (residential cum other use)

In 2011, out of total 2,31,512 occupied housing units in GMC+OG, 2,27,719 units are exclusively residential and 3793 are used for residence-cum-other uses as mentioned in table 6-6. Out of total residential housing units, majority units are in good condition and livable, while only 8% are in non-living condition. Ratio of housing units in good condition is much higher in GMC+OG (70%) as compare the share of good conditioned occupied housing units in the state (33%) and district (47%). However, the share of livable housing condition in the state and in the district is much higher as compared to the GMC+OG area.

In slum houses category, houses in good condition which are 55% followed by houses in liveable condition which are 37% and the least are in dilapidated condition which are 8%. Also, the condition of houses mentioned for the residential cum other use of

slum houses, where 22% percent are in dilapidated condition. In comparison to state slum housing condition the share of dilapidated slum housing in Guwahati is lesser than the state. But in the case of residential cum other uses share of dilapidated structures are higher than the state's overall dilapidated structure percentage.

6.1.5 Construction Material of Houses

6.1.5.1 Material of Roof:

Majority of households in GMPA other than rural households have G.I. Metal sheets for roofing because they are great protection against rain and is easily available in the region. In GMPA area, around 66.72% of houses have G.I. Metal sheet roofs, which is still comparatively low numbers than the states (74.2%).

Table 6-8: Material of Roof in GMPA

Area Name	Total number of HHs	Grass/ Thatch/ Wood/ Mud	Plastic Polythene	Handmade Tiles	Machine made Tiles	Burnt Brick	Stone/ Slate	G.I./ Metal/ Asbestos sheets	Concrete	Any other material
Assam	6,367,295	18.60%	2.10%	0.70%	0.30%	0.10%	0.80%	74.20%	2.90%	0.20%
Kamrup Metro	3,85,104	0.93%	0.22%	0.39%	0.15%	0.32%	2.71%	67.96%	27.22%	0.10%
GMPA (Excluding Rural)	2,46,685	0.68%	0.21%	0.40%	0.16%	0.33%	2.71%	66.72%	28.68%	0.11%

(Source: Census of India 2011)

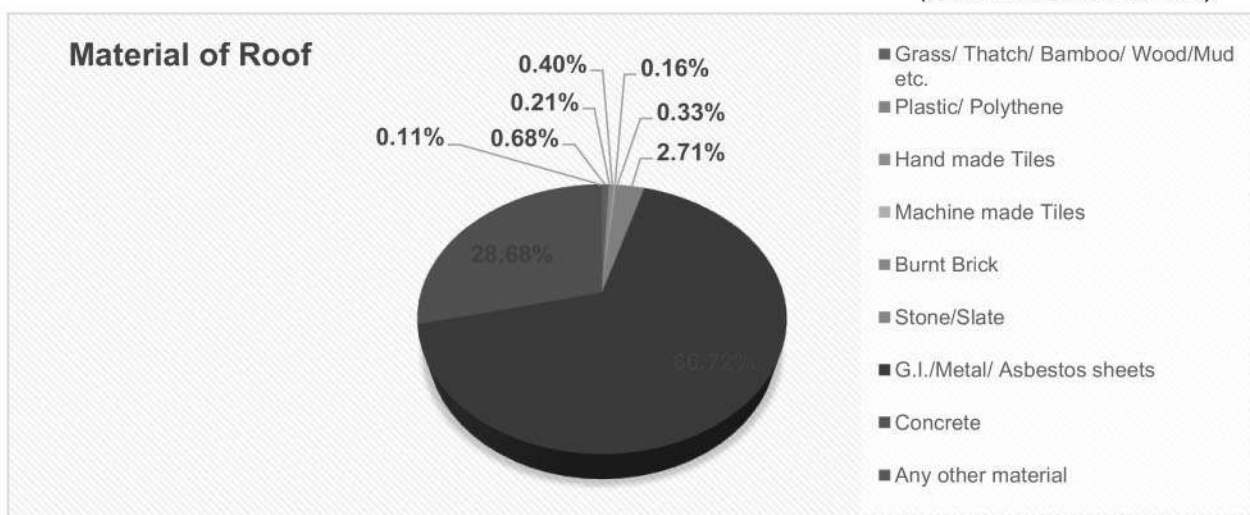


Figure 6-10 Housing by Material of Roof

In GMPA 66.72%, households have the G.I and Metal roofing material. At the same time, around 28.68% households in GMPA have the permanent roofs made of

concrete; the number is comparatively higher than the number of households with the permanent roofs in the state and the districts.

6.1.5.2 Material of Wall:

Table 6-9: Material of Wall

Area Name	Grass/That ch/ Bamboo	Plastic/ Polythene	Mud/ Unburnt brick	Wood	Stone not Packed with mortar	Stone packed with mortar	G.I./ Metal/ Asbestos sheets	Burnt brick	Concrete	Any other material
State	66.40%	0.60%	3.60%	1.60%	0.70%	1.40%	1.10%	21.20%	2.90%	0.50%
Kamrup Metro	26.32%	0.63%	1.94%	1.33%	1.45%	4.43%	0.73%	47.30%	13.50%	3.10%
GMC + OG	23.09%	0.60%	1.46%	0.80%	1.54%	4.68%	0.56%	50.92%	16.21%	0.22%

(Source: Census of India 2011)

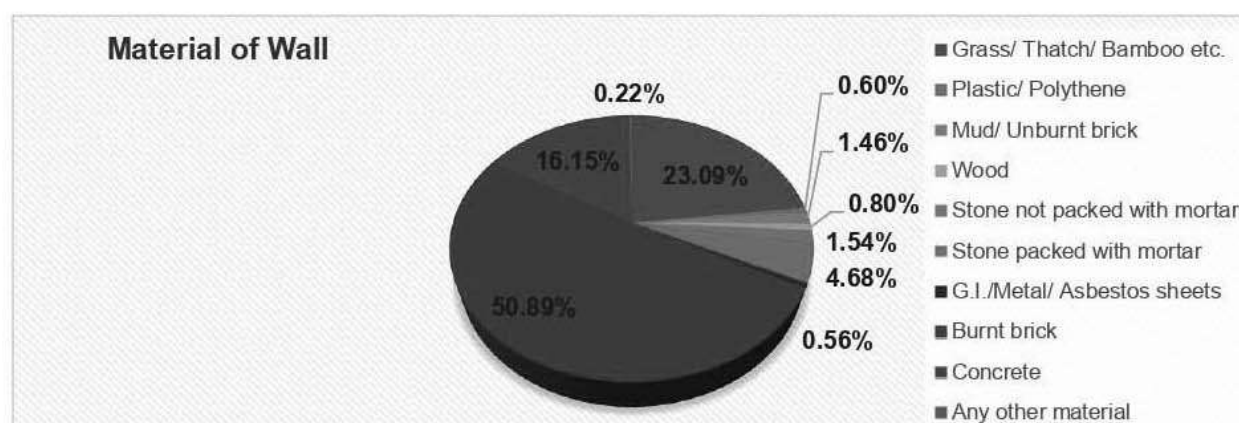


Figure 6-11: Housing by Material of Wall

Majority of houses in GMC and OG are Pucca houses with walls made of either burnt bricks (50.89%). Houses made with bamboos and thatch is the second majority in GMC area (23.09%). In fact, in Kamrup district also majority of the houses are of pucca type (47.3%). However, on the other hand, majority of houses in the state (66.40%) are Kachha houses with the walls made of grass, bamboos, and thatch.

6.1.5.3 Material of Floor:

In GMC and OG, cement is predominantly used material for flooring. Almost 61.43% households in GMC and OG have permanent flooring made of cement, and only 20% houses are with flooring made of mud, especially in the slums and other low-income group areas. On the other hand, at the state and the district levels, mud is the predominant flooring material widely used. Majority of households in the state (78.6%).

Table 6-10: Material of Flooring

Area Name	Mud	Wood/ Bamboo	Burnt Brick	Stone	Cement	Mosaic/ Floor Tiles	
State	78.6%	2.1%	1.2%	0.4%	16.6%	1.0%	0.1%
Kamrup Metro	27.03%	0.93%	2.92%	1.04%	57.16%	10.62%	0.30%
GMC+ OG	20.04%	0.51%	2.81%	1.33%	61.43%	13.50%	0.38%

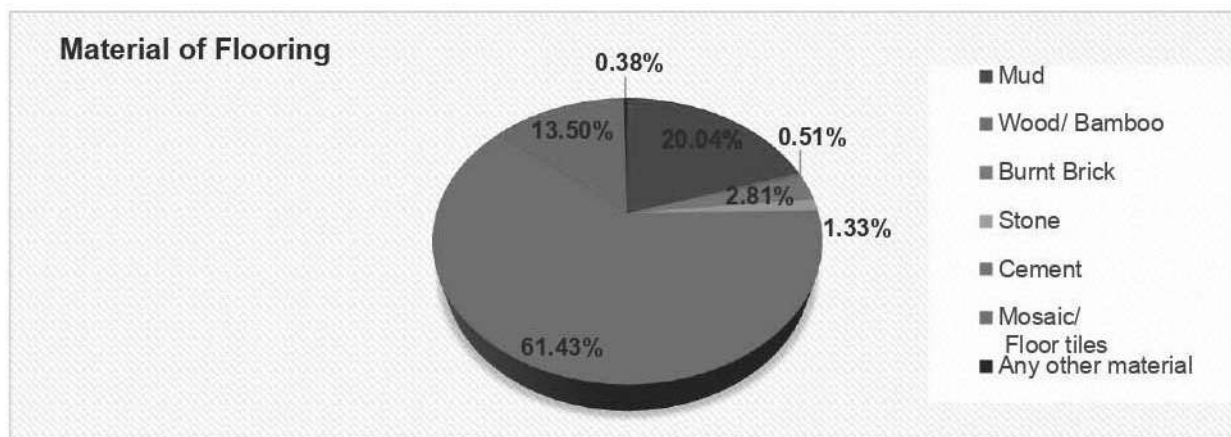


Figure 6-12: Housing by material of flooring

6.1.6 Ownership Status of Houses

According to census 2011, the housing sizes are classified as number of dwelling units with following categories.

1. Dwelling units with no exclusive rooms
2. Dwelling units with single room
3. Dwelling units with two and three rooms
4. Dwelling units with four and five rooms
5. Dwelling units with six and above rooms

Table 6-11: Housing Ownership Urban area in GMPA (Urban)

Area Name	Ownership status	Total no. of house holds	Households having number of dwelling rooms						
			No exclusive room	One room	Two rooms	Three rooms	Four rooms	Five rooms	Six+ rooms
GMPA (Urban)	Total	246685	4223	54283	63214	51992	36467	18631	17876
	Owned	54%	44%	21%	46%	60%	76%	86%	89%
	Rented	41%	47%	74%	48%	35%	21%	12%	9%
	Any Other	5%	8%	5%	6%	5%	3%	2%	2%

(Source: Census India, 2011)

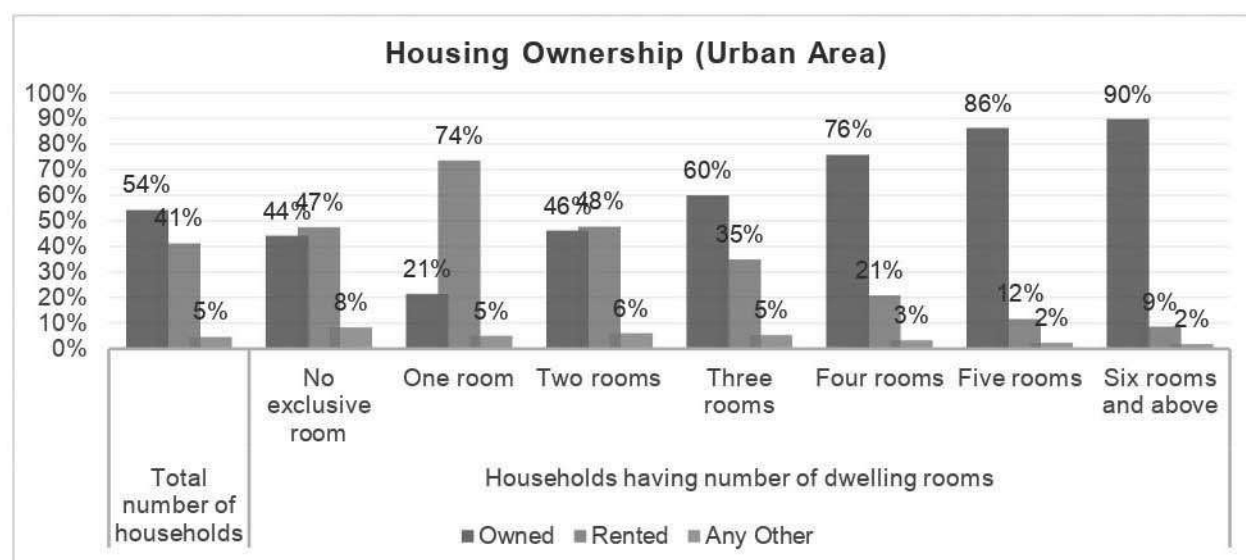


Figure 6-13: Housing Ownership by Dwelling Rooms

From the figure 6-14, it is observed that 22% and 21% of total households are owning single room and three-room units respectively in the urban area while 26% households live in two room dwelling units. In Guwahati percentage of rented single room occupancy is higher (74%). Out of 63,214 two room units 46% are owned and 48% are on rent. It is also observed that only 7% of the Households in urban area are living in five plus rooms where only 9% are rented and major units are under ownership status. In overall the 2% of the households are living without any exclusive room in urban area on the total urban households.

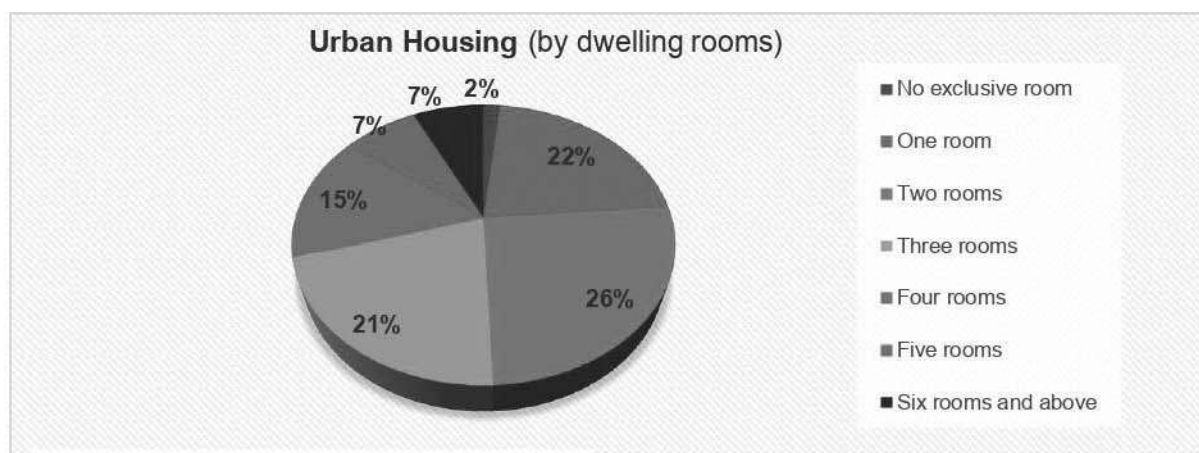


Figure 6-14: Housing ownership of dwelling in GMPA

Table 6-12: Housing ownership Rural Area

Area Name	Ownership status	Total no. of house holds	Households having number of dwelling rooms						
			No exclus ive room	One room	Two rooms	Three rooms	Four rooms	Five rooms	Six+ rooms
Guwahati (Rural)	Total	24540	389	5947	8753	4824	2498	1127	1001
	Owned	88%	82%	75%	92%	93%	96%	95%	97%
	Rented	8%	14%	20%	5%	6%	1%	2%	2%
	Any Other	3%	4%	5%	3%	1%	3%	3%	1%

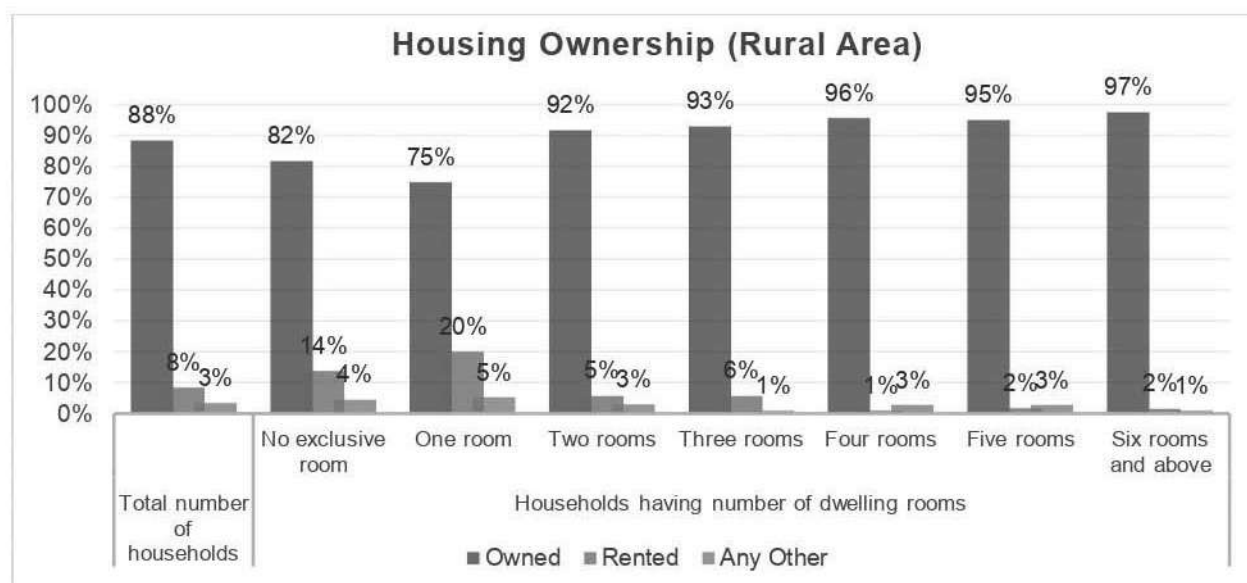


Figure 6-15: Housing Ownership by dwelling rooms (rural)

The housing ownership data of Guwahati Rural area is calculated based on Kamrup Rural housing ownership shares in different categories. Figure 6-16 describes that 24% of total households are owning single room in the rural area while 36% and 20% households live in two and three-room dwelling units respectively. Out of 8753 two rooms and 4824 three room units 92% are owned, whereas only 6% are on rent status. It is also observed that 5% to 10% of the Households are living in four-five dwelling rooms where mostly are owned dwelling units, only 2% of them are rented.

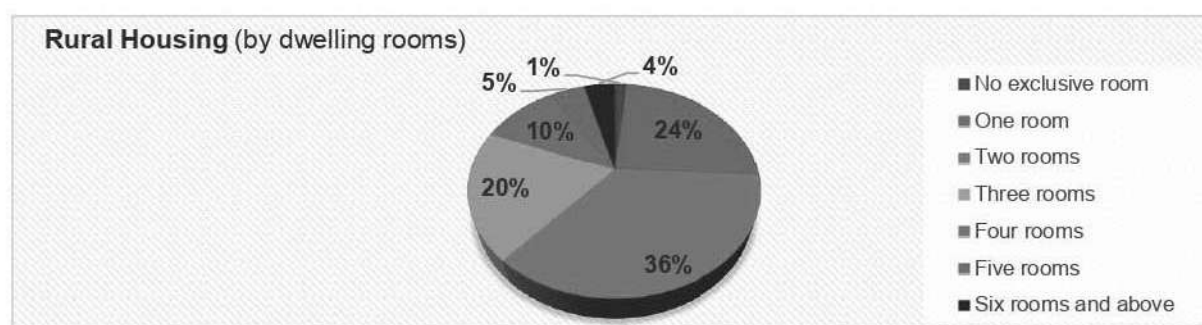


Figure 6-16 Rural Housing ownership of dwelling in GMPA

Table 6-13: Housing Ownership by Dwelling Rooms

Area Name	Total no. of households (Excluding Vacant Houses)	Households having number of dwelling rooms						
		No exclusive room	One room	Two rooms	Three rooms	Four rooms	Five rooms	Six+ rooms
GMPA	271225	4610 (2%)	60260 (22%)	72103 (27%)	56796 (21%)	38902 (14%)	19719 (7%)	18834 (7%)

(Source: Compiled by Consultant)

Table 6-13 illustrates the current housing condition of GMPA area. 27% are two room dwelling units as majority followed by single room category (22%), while 2% not having any exclusive rooms. Overall, considered area observed having 57% housing under ownership status and 38% under rent category status. 5% housing have not clear ownership presented in figure 6-17.



Figure 6-17: Housing Ownership in GMPA

6.1.7 Services

6.1.7.1. Source of Drinking Water:

On an average, more than half of the household in the region have source of drinking water within their premises. Water taps, wells, hand pumps, tube wells or boreholes are the primary sources of drinking water for households within-premises water facilities, while river, pond, lake, spring, and tank are the main drinking water source of water for them who do not have sources within their premises or nearby their premises and need to go little far.

Table 6-14: Drinking Water Supply in GMPA

Total/ Rural/ Urban	Location	No. of HHs.	Main Source of Drinking Water							
			Tap	well	Hand Pump	Tube/ Bore Well	Spring	River/ Canal	Tank/ Pond/ Lake	Others
State	Within the premises	55%	10%	17%	62%	11%	0%	0%	0%	0%
	Near the premises	27%	12%	19%	40%	8%	1%	5%	14%	2%
	Away	18%	9%	24%	31%	6%	5%	12%	5%	7%
Kamrup Metro	Within the premises	77%	84%	86%	80%	93%	0%	0%	0%	0%
	Near the premises	11%	9%	8%	11%	4%	32%	43%	74%	26%
	Away	12%	7%	6%	9%	3%	68%	57%	26%	74%
GMPA (excluding rural area)	Within the premises	82%	86%	82%	85%	93%	0%	0%	0%	0%
	Near the premises	9%	9%	9%	10%	4%	38%	55%	86%	27%
	Away	9%	6%	7%	5%	3%	62%	45%	14%	73%

(Source: Compiled by Consultant)

As compared to the state, both districts GMPA have higher number of houses with the drinking facilities within in the premises i.e., 82%. However, data regarding availability of drinking water facility of Slum area are unknown. Unlike GMPA where taps and tube wells are the primary source of water for the in-premises water facilities, hand pumps and tube well are the preliminary source of drinking water for the district.

6.1.7.2 Source of Lighting:

Around 92.5% of households in Guwahati planning area excluding villages have electricity connection. Similarly, majority of households in other urban centres of the project area have electricity connection. However, at the state level, less than 37% household have electricity connection, which means electricity has not yet reached to the all-rural areas in the state, and kerosene is still being used as a main lightening source widely in Assam. In GMPA, the main source of lightning is electricity, which mainly provided by Assam State Electricity Board.

Table 6-15: Source of Lighting

Area Name	No. of HHS.	Main Source of Lighting					
		Electricity	Kerosene	Solar Energy	Other Oil	Any Other	No Lighting
State	6,367,295	37.0%	61.8%	0.8%	0.1%	0.1%	0.2%
Kamrup Metro	2,90,388	86.39%	12.96%	0.18%	0.12%	0.06%	0.29%
GMPA (excluding rural area)	2,46,685	92.50%	6.94%	0.14%	0.09%	0.05%	0.27%

(Source: Census of India 2011)

6.1.7.3 Type of Latrine Facility:

Around 97% of households in GMPA urban area have latrine facility within the premises. Similarly, majority of households in other urban centers of the project area also have latrine facility within the premises. However, around 8% households in the state and districts do not have latrine facilities within their premises. Septic tank is the most common type of treatment for in-premises latrine facility found in the project area. Although these data do not cover the latrine facility in Slum areas, where sanitation facility is poor compared to other Urban Housing.

Table 6-16: Type of Latrine Facility

Area Name	Number of Hhs Having Latrine Facility Within	Type of Latrine Facility Within the Premises								Number of Hhs Not Having Latrine	No Latrine Within Premises	
		Flush/Pour Flush Latrine Connected			Pit Latrine		Night Soil Disposed Into	Service Latrine				
		Piped Sewer	Septic Tank	Others	Ventilated	Open Pit		Night Soil Remo	Night Soil Service		Public Latrine	Open
State	65%	5%	15%	8%	10%	24%	1%	0%	1%	35%	2%	33%
Kamrup Metro	92%	21%	57%	4%	10%	6%	1%	1%	0%	8%	11%	89%
GMPA (excluding rural area)	97%	22%	60%	3%	8%	4%	1%	1%	0%	3%	28%	72%

(Source: Census of India 2011)

6.1.7.4 Type of Bathroom and Drainage Connectivity:

Over half of the households in the urban centers of the project area have bathing facilities within their premises. In fact, 86% households in GMPA Urban area have in-premises bathroom facility. On the other hand, 58% or more households in the state and the district do not have in-premises bathroom facility.

Except GMPA urban, the rest of the region is facing issues due to the lack of properly planned drainage system (suffering from lack of planned drainage system) for wastewater discharge. However, the 74% of GMPA area has wastewater outlet connected to the drainage system, only 26% of the area has planned closed drainage system, and the rest of 48% area has open drainage system connected to the wastewater outlets from houses. These data only cover the permanent Urban household.

Table 6-17: Type of Bathroom and Drainage Facility

Area Name	Number of HHs having Bathing Facility within the Premises			Wastewater Outlet Connected to		
	Yes		No	Closed Drainage	Open Drainage	No Drainage
	Bathroom	Enclosure without roof				
Assam	24%	17%	58%	4%	17%	80%
Kamrup Metro	77%	10%	13%	23%	43%	34%
GMPA (excluding rural area)	85%	9%	6%	26%	48%	26%

(Source: Census of India 2011)

6.2 Gross Housing Density

Table 6-18 Gross Housing Density

Sr. No.	Name of Area	No. Of Household	Area (sq.km.)	Housing Density
1	GMC + OG (60 Wards)	2,3,0769	178.24	1295
2	8 CT (Census Town)	13622	25.71	530
3	North Guwahati (4 wards)	2294	3.34	687
4	76 Rural Villages	24,540	120.71	203
Total GMPA		2,71,225	328.00	827

(Source: Compiled by Consultant)

Cities in India tend to have highest housing density in the central area. The density often progressively falls towards outskirts of the city this phenomenon is produced by intermixing of land uses in the central area particularly commercial activities, with residences. Housing density is defined as the average number of houses in one square kilometre of land or total number of households per total area. The housing density is important to be studied in urban study because it describes the level of openness or congestion in an area in terms of built-up area and open areas with respect to total area. Analysis of housing density in Guwahati MPA has revealed the overall gross housing density as 827. Out of which GMC and OG area is highly dense area, where housing density within this area is 1295 houses per sq. km. and lower housing density within urban area is observed around 8 census towns where it is 530 houses per sq. km. is situated. The high housing density in GMC and OG area is not a reflection of high-rise building, but it is essentially due to the high occupancy rate and land coverage.

6.3 Housing Trend

Decadal Housing trend from year 1991 to 2011 for Guwahati Master Plan Area is given below. According to Census 2011, Municipal + OG area has less household requirement compared to rural area. Trend indicates the progressive fulfilment of household requirement from year 1991 to 2011.

Table 6-19: Housing trend according to decades

Year	1991				2001				2011			
Guwahati Master Plan Area Planning area	Population	Households	Required Households for 1991	Shortage	Population	Households	Required Households for 2001	Shortage	Population	Households	Required Households for 2011	Shortage
GMC + OG (60 Wards)	584342	125906	139129	13223	818809	186006	194955	8949	962334	230769	229127	-1642
8 Census Towns	18357	3216	4172	956	7668	1526	1743	217	59497	13622	13522	-100
North Guwahati (4 Wards)	---	---	---	---	16286	3179	3701	522	10328	2294	2347	53
76 Rural Villages	105256	18143	23922	5779	147389	27758	33498	5740	113381	24540	25768	1228
Total	707955	147265	167223	19958	990152	218469	220034	15427	1145540	271225	270765	-460

(Source: Compiled by Consultant)

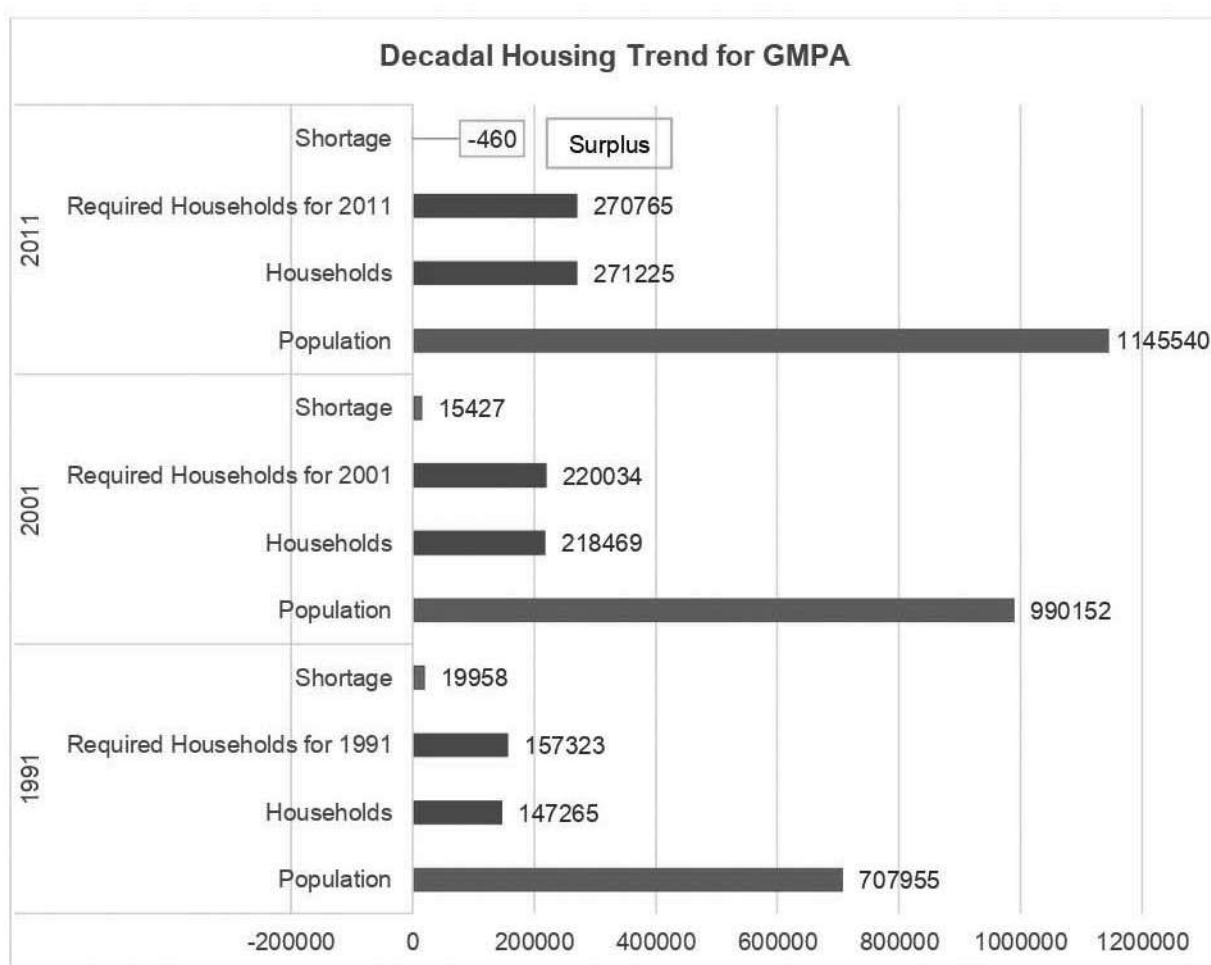


Figure 6-18: Decadal Housing Trend for the years 1991, 2001, 2011

6.4 Issues in Housing Infrastructure

The Master plan for Guwahati CMP-2025, deals with the housing sector in terms of:

- Present and future shortage in housing stock
- The composition of housing units in terms of occupancy level
- Role of private developers in tackling housing situation and shortage
- Housing for poor.

Table 6-20: Gaps and issues in the housing sector¹

Issue	Description
Bottlenecks in Master plans	The Master Plans while discussing the housing backlogs and future stock requirement does not talk about the land requirements for the same. It is pertinent to add here that the city is sprawling outwards. A lot of these areas coming under the sprawl are significant natural features like natural wetlands, watershed areas; fragile hilly areas which are not fit for development. This becomes an important issue in the light of the fact that the city faces frequent landslides and flooding during rainy seasons. In spite of the fact that the building Bye-laws do exist, the absence of their mention in an important document like Master Plan and within the section on housing is a big gap. Also considering urban flooding as one of the detriments for city, housing locations for future also need to be taken into account in the planning stage itself.
Lack of planning for slums	If a city has to be slum free, the housing needs of all the residents of the city including the poor would have to be planned and provided for while allocation of housing stock. In the absence of such an approach, the slums would continue to be built in the hazardous and vulnerable locations in the city, ever increasing the vulnerability of the residents to climate related events and natural disasters.
Construction activities	The city is not thinking of building construction that is apt for the location, for example consideration to frequent floods, climatic conditions etc. Promoting this kind of construction would not only mainstream good construction practices but also reduce the structural vulnerability for the city to various climate related disasters and events

¹ Climate Proofing Guwahati, Assam: City resilience strategy & Mainstreaming Plan, Teri, 2013

6.5 Growth in Real Estate

The real estate sector is one of the most globally recognized sectors. In India, real estate is the second largest employer after agriculture and is slated to grow at 30 per cent over the next decade. The real estate sector comprises of further sub sectors like township, housing, retail, hospitality, infrastructure and commercial. The growth of this sector is well complemented by the growth of the corporate environment and the demand for office space as well as urban and semi-urban accommodations. The construction industry ranks third among the 14 major sectors in terms of direct, indirect, and induced effects in all sectors of the economy.²

Guwahati region experienced almost 28% population growth between the census year 1991 and 2011. This increasing trend has resulted in promotion of huge amount of all kind infrastructure development in Guwahati Planning Area. It is currently the largest city of entire northeast India, with a fair infrastructure availability and improved city facilities people find this place having greater potential in every sector including economy, employment, education etc. thus it receives significant number of floating populations every year. This city act as an origin of the major trunk road which connects the all the other states of northeast with the core country. It is acting as a major node for its resource mobilization.

Apart from that being a gateway to all other states of Northeast, Guwahati always had an immense importance even opening many opportunities for Real Estate within the city region in terms of residential, commercial also industrial.

The real estate growth witnessed in the region is a result of the afore mentioned reasons and it is poised to grow at a good pace with development initiatives taken by the Government of Guwahati and measures adopted as part of Master Plan 2045 which will open more residential properties for development along with industrial properties and Industrial corridors. With these proposals being adopted and implemented by the government, it will create an exponential growth in the real estate market of the Guwahati region. Hence based on the study of above facts, it indicates that there are five growth driven factors of Indian state's real estate. They are:

- Rapid Urbanization
- Significant rise in consumerism
- Policy and regulatory reforms

² Source: Department of Industrial policy and promotion 2016

- Surge in industrial and business activities
- Increasing demand for newer avenues for entertainment, leisure and shopping

Considering the above factors, the Real estate developers aim to utilise opportunities in line of market demand. Hence, these phenomena of possible development act as catalyst in the development process by creating more demand for residential and commercial area in the Planning Area. On the other hand, it gives boost to the property values and paves the way to keep the real estate sector vibrant in Planning Area. However, while this development is progressive for human beings, sociologist and ecologists are concerned about the fate of the reserved forest, wetlands and water bodies which is almost comprising 29% of entire master plan area. More and more farmers of Guwahati region will be forced to sell their lands to builders as they pay lucrative amounts for the plots. Areas which were barren or even wetlands at one point are now seeing construction of residential or commercial buildings. Therefore, in order to bring the orderly development and to protect eco sensitive lands, the Government of India has come up with "The Real Estate (Regulation and Development) Act, 2016".

6.5.1 The Real Estate (Regulation and Development) Act, 2016

The Real Estate (Regulation and Development) Act, 2016 is an Act which protects the interest of purchasers of plots and dwelling units / flats. It further helps to boost investments in the real estate industry. The Act mandates establishment of Real Estate Regulatory Authority (RERA) in each state for regulation of the real estate sector and also acts as an adjudicating body for speedy dispute redressal. The Real Estate Regulatory Authority regulates the real estate sector and ensures sale of plot, apartment or building, as the case may be, or sale of real estate project, in an efficient and transparent manner and also protects the interest of consumers in the real estate sector. The act has got provision for an adjudicating mechanism for speedy dispute redressal and also for establishment of Appellate Tribunal to hear appeals filed under the Act.

It is now a mandate for the city's real estate developers to register their projects under the Real Estate (Regulation and Development) (RERA) Act 2016, after the Assam Government notified the Act as Assam Real Estate (Regulation and Development) Rules 2017 in May, 2017.

6.5.2 Salient Features of the Real Estate Regulation Act (RERA), 2016

- The act establishes the state - level Real Estate Regulatory Authority for the regulation and promotion of the real estate sector, under section 20;
- The Act mandates prior registration of a project with the Real Estate Regulatory Authority under section 3(1). It also states that prior to registration no promoter shall advertise, market, book, sell or offer for sale, or invite persons to purchase in any manner any plot, apartment to building in any real estate project registering the real estate project with the Authority;
- The Act additionally provides for the registration of real estate agents by the real Estate Regulatory Authority under Section 34(a).
- The Act lays down the functions and duties of promoters under section 4, and under section
- it provides that once registration is applied for, RERA is given a time period of 30 days to either approve upon registration, the promoter shall be provided with a log-in and password to access the website of the authority, and shall create his web page on the website and enter the details of proposed projects.
- Under Section 4(2) (l) (d), it makes mandatory upon the promoters to deposit fund amounting to 70 per cent to over the construction cost of the project in a separate bank account to be maintained at a scheduled bank, to prohibit unaccounted money from being pumped in and out of the sector to the detriment of the consumer.
- The Act states, under section 4(2) (d), the project shall be developed by the promoter in accordance with the sanctioned plans, layout plans and specifications as approved by the competent authorities.
- Under Section 15(1), promoter shall not transfer or assign his majority rights and liabilities in respect of a real estate project to a third party without obtaining prior written consent from two-third allottees.
- Under Section 19, the Act provides for the rights and duties of allottees, like allottee shall be entitled to know stage-wise time schedule of completion of the project, right to claim the refund of amount paid along with interest and compensation in the manner as provided under the Act.
- Under Section 38(1), the Act provides for penalties and offences in case of violations of law by the promoters, allottees and the real estate agents.

6.5.3 Need for Housing Policy

Housing is an important economic activity besides being a necessity. As part of the construction industry, which accounts for more than 50 per cent of the development outlays, housing has emerged as a major sector of economy having backward and forward linkages with almost all other sectors. With the increasing urbanisation and rural to urban migration for employment, it becomes inevitable to provide basic infrastructure to people. Thus, to meet this demand, Government of India is introducing

various policies like Pradhan Mantri Aavas Yojana (Housing for all), affordable housing policies etc. For the vulnerable and weaker sections of the society, the Government is playing the role of direct provider. A Centrally sponsored scheme called Valmiki Ambedkar Awas Yojana (VAMBAY) was launched with a view to ameliorating the conditions of the urban slum dwellers living below poverty line who have inadequate shelter. The scheme has the primary objective of facilitating the construction and upgradation of the dwelling units in the slum areas and to provide health and enabling urban environment through community toilets under Nirman Bharat Abhiyan, a component of the scheme. The scheme is being implemented through HUDCO.

The Pradhan Mantri Aavas Yojana is being implemented during 2015-2022 and provides central assistance to Urban Local Bodies (ULBs) and other implementing agencies through States/UTs for:

- In-situ Rehabilitation of existing slum dwellers using land as a resource through private participation
- Credit Linked Subsidy
- Affordable Housing in Partnership
- Subsidy for beneficiary-led individual house construction/enhancement

Credit linked subsidy component is being implemented as a Central Sector Scheme while other three components as Centrally Sponsored Scheme (CSS). All statutory towns as per Census 2011 and towns notified subsequently would be eligible for coverage under the Mission.

In the spirit of cooperative federalism, mission provides flexibility to the States for choosing the best options amongst four verticals of mission to meet the demand of housing in their states. Process of project formulation and approval in accordance with the mission Guidelines has been left to the States so that projects can be formulated, approved and implemented faster.

Other than these interventions, various other interventions were done by the government of India. A historical context of policy interventions towards Housing in India is described below:

- The policies of urban development and housing in India have had a long journey since independence. In early 1950s, the pressure of urban population and lack of housing along with basic services was an issue of great concern to the Government as well as to the civil society. It has generally been the responsibility of States to intervene towards meeting the housing requirements of the vulnerable sections of

society and to create an enabling environment for provision of shelter to all on a sustainable basis.

- As part of the First Five Year Plan (1951-56), concrete governmental initiatives began with a focus on institution-building and housing for weaker sections of society. Government undertook construction of houses for Government employees and industrial workers (through Industrial Housing Scheme). The urban land was getting scarce for provision of housing especially for the middle and low-income groups, resulting in the government enacting the Urban Land (Ceiling & Regulation) Act, 1976. Housing and Urban Development Corporation (HUDCO) was set up in 1970 to provide affordable housing and provide specialized attention to critical segments of infrastructure development in cities and towns.
- In the late 80's and early 90's, Government envisaged a larger role for the private sector in the construction of housing, whereas government focused on mobilization of resources, provision for subsidized housing for the poor and acquisition of land. The National Housing Bank (NHB) was set up as a wholly owned subsidiary of Reserve Bank of India (RBI), in 1988 under the National Housing Bank Act, 1987 to expand the base of housing finance. These were coupled with schemes aimed at provision of housing and basic services for the urban poor.
- The first National Housing Policy was announced in 1988 to eradicate houselessness and improve the housing conditions. Thereafter a revised National Housing Policy was announced in 1994 as a by-product of economic reforms process initiated in 1991. The goal of this policy was to increase the supply of land and basic minimum services with a view to promote a healthy environment. Subsequently, a Housing and Habitat Policy was unveiled in 1998 with the vision of "shelter for all" and better quality of life to all citizens by using the potential of public, private and household sectors. The key objective of the policy was on creating strong Public-Private Partnership (PPP) for tackling the housing problem.
- The National Urban Housing and Habitat Policy (NUHHP) 2007 was formulated with the goal of 'Affordable Housing for All' with special emphasis on vulnerable sections of society such as Scheduled Castes/Scheduled Tribes, Backward Classes, Minorities and the Urban Poor. The spotlight was on 'habitat development' with a 'Regional Planning Approach' with the role of Government as a 'facilitator' and 'regulator.' The NUHHP-2007 lays emphasis on earmarking of land for EWS/LIG groups in new housing projects while retaining Governments role in social housing so that affordable housing is made available for EWS and LIG categories either on ownership or on rental basis.

Recently, the government of India has also come up with the Draft Model State Affordable Housing Policy for Urban Areas in 2014. The aim of this policy is to "create an enabling environment for providing "affordable housing for all" with special emphasis on EWS and LIG and other vulnerable sections of society such as Scheduled castes/Scheduled Tribes, Backward Classes, Minorities and senior

citizens, physically challenged persons in the State and to ensure that no individual is left shelter less. The Policy further aims to promote Public Private People Participation (PPPP) for addressing the shortage of adequate and affordable housing.”

In order to supplement the efforts of the State Government, it is anticipated that the Government of India support will be forthcoming in the following aspects:

Through National Policies, Programmes and Schemes and act as a facilitator in the creation of affordable housing stock.

- The Central Government will also on one hand provide for capital grants support to Affordable Housing projects under various schemes to act as a lever to boost the supply of affordable housing and also provide for greater channelization of credit to the urban poor to enhance their purchasing power on the other.
- Ministry of Housing and Urban Poverty Alleviation from time to time will provide inputs to the Ministry of Finance for providing fiscal and financial incentives to this segment.
- The Government of India shall also strive to accord industry status to the real estate segment.
- The Government of India shall also consider making Viability Gap Funding available for Affordable Housing projects.
- Facilitate greater flow of capital through external sources like the External Commercial Borrowings and Foreign Direct Investment.
- The Central Government will encourage development of new avenues for project financing for Affordable Housing including that from the insurance and pension funds.
- The recent initiatives of Government of India like the Credit Risk Guarantee Fund Trust and Urban Housing Fund needs to be further promoted.

Apart from the interventions to be done by central government, state government also has to intervene in order to achieve the central governments’ goal of providing affordable housing for all under the Model State Affordable Housing Policy for Urban Areas.

State interventions and specific actions points under Draft Model State Affordable Housing Policy for Urban Areas:

Since the Constitution of India envisages provision of Housing as the primary responsibility of the State Government, major initiatives are proposed to be taken by the State as part of the vision of the Government to provide affordable housing for all residents. Few interventions are listed below:

- At least 15% of the total project Floor Area Ratio (FAR)/Floor Space Index (FSI) or 35% of the total number of dwelling units, whichever is higher, will be reserved for EWS category.
- The State Government including that of its agencies such as the Urban Development Authorities, Housing Boards, other parastatal agencies and Urban Local Bodies (ULBs) will, as far as possible, provide land for affordable housing projects.
- Subject to any Central Law, a people friendly land acquisition policy for the State will be created for undertaking affordable housing projects.
- Various models for assembling land will be encouraged in both Government and Private sectors by offering trunk infrastructure facilities and transportation linkages to such site.
- The policy aims to create an inventory of land holdings in cities to constitute a land bank and prepare an asset management plan for better management of the available land and targeting its supply to create affordable housing dwelling units. The State shall compile and maintain the inventory.
- The State will also develop innovative ways for capturing the value of land by way of developing infrastructure and regional connectivity.
- The State shall notify a policy on property rights to slum dwellers to provide title to the land and a non-eviction policy for residents of slums with over 5 years of documented stay in a particular location.
- Mortgageable leasehold property rights and land titles for the EWS and LIG categories shall be facilitated by the Revenue Department and the ULBs.
- Infrastructure services including water supply, sanitation, health, education facilities to existing housing colonies where there is absence of such facilities will be ensured.
- Special dispensation to the socially vulnerable sections like senior citizens, women, students, physically challenged, SC/ST/OBC and Minorities, etc. of the State shall be made.
- In situ Slum upgradation of slums and allied infrastructure will be taken up by tying up various schemes of Central and State Government.

The agencies responsible for various works to be implemented in Assam under majority of the central government's initiative are Town and Country Planning Department, Housing Board or Slum Board etc..

In GMPA region, due to pressure in the urban areas, rampant development has taken place. Therefore, in order to have a streamlined growth in the coming future, Guwahati will require a Housing policy for the GMPA. Various Indian states like Madhya Pradesh, Chhattisgarh, Maharashtra, Karnataka etc. have introduced housing policy in order to have ordered development in the state. Thus, Assam Government shall

also come up with a detailed Housing Policy. This policy should focus on various issues being faced by regions in terms of Housing.

It is noticed that a large number of unapproved layouts and sub-divisions have been developed in the Guwahati regions without adequate infrastructure and public civic amenities and most of the plots in such layouts and sub-divisions have been purchased by ignorant people and there is no way to convert these layouts and sub-divisions or plots back to their original land use;

It is expedient to regularise the plots in such unapproved layouts or sub-divisions, so as to protect the interests of ignorant purchasers and to mobilise financial resources in order to provide basic infrastructure facilities in areas where such unapproved layouts have come up.

Regularization of unapproved layouts will enable the purchasers to avail institutional finances to build houses at affordable interest rates and to improve their security of tenure and thereby their quality of life. It is also observed that regularisation of sold out plots alone without considering the layout or subdivision as a whole will result in discontinuous pockets of development, causing enormous difficulties to the Local Bodies to provide services to the regularised plots in isolation and therefore, it is considered necessary to regularise these unapproved layouts and sub-divisions in their entirety by insisting to widen the roads, improve circulation, reserve areas for open space and public purpose to the extent feasible in each layout.

Effect of regularization – Plots regularised under this scheme shall be deemed to be regularised for residential use.

Some imperative objectives of the Housing Policy to be formulated is described as under:

- To facilitate affordable housing in urban and rural areas, create adequate housing stock for Lower Income Group (LIG), Economically Weaker Section (EWS) and shelters for the poorest of the poor on ownership or rental basis.
- To pursue the target of cities without slums through equitable slum redevelopment and rehabilitation strategy and shelters for the poor.
- To deregulate housing sector and encourage competition and public private partnerships in financing, construction and maintenance of houses for Lower Income Groups (LIG) and Weaker Sections of the society.

- To rationalize development control regulations and streamline approval procedures.
- To promote rental housing and incentives to different options of rental housing for weaker sections.
- To facilitate the redevelopment and renewal of inner city areas and dilapidated buildings through options of land assembly; conserving heritage structures and places of archeological importance.
- Encourage technology innovation, training and capacity building of the construction workers to enhance their productivity and improve quality of housing stock.
- To promote larger flow of funds for investment in housing and infrastructure using innovative products and appropriate institutional mechanism.
- To encourage progressive shift from target orientation to a demand driven approach as also from a subsidy based housing scheme to cost sharing or cost recovery-cum-subsidy schemes.
- To provide for mandatory construction of EWS/LIG housing by the private sector in the government-provided land, government facilitated site or their own projects.
- The policy will orient towards setting up of a land bank to ensure smooth supply of land for projects specifically meant for construction of houses to low income segment households
- To create skilled manpower for building construction industry and create employment opportunity for low income group.
- To conserve ecologically sensitive areas and promote environmentally sustainable cities and townships.
- To establish Management Information System to strengthen monitoring of building activity in the Union Territory.

6.5.4 Affordable housing policy

A policy document is a set of guidelines to direct the actions of all persons/ institutions involved or connected regarding any area of activity. Preparation of a housing policy is the need of the hour with respect to growing requirement of shelter and related infrastructure. As discussed in the previous section requirement for shelter is growing in context of rapid urbanization, migration to cities, mismatch between demand and supply of housing (especially affordable housing for EWS/ LIG), and inability of the urban poor to access the formal housing market to fulfil its housing need.

6.6 Housing Stock and Shortage

Housing shortage is defined as the set of populations who does not hold any house. There may be a growing concern for homeless across big cities during winters, but progress in construction of night shelters has been very slow across most of the states despite the centre providing 75% of funds required for building and refurbishing shelters for the urban homeless. In absence of city level data on the houseless population and pavement dwellers, the houseless population is derived from the data published as part of Census of India, 2011. Details of housing stock, Municipal Corporation and urban centre wise, in GMPA were computed based on the Census of India, 2011 and are presented in the table 6-21

Table 6-21 Housing Stock in GMPA 2011

Sr. No.	Guwahati Planning Area	No. Of Household 2011	Total no. of Housing Stock 2011	Livable Housing Shortage
1	GMC + OG (60 Wards)	2,37,069	2,28,461	2,308
2	8 Census Town	13,622	13,213	409
3	North Guwahati (4 Wards)	2,294	2,271	23
4	76 Rural Villages	24,540	20,368	4,172
Total for GMPA		2,71,225	2,64,314	6,911

(Source: Compiled based on Census 2011)

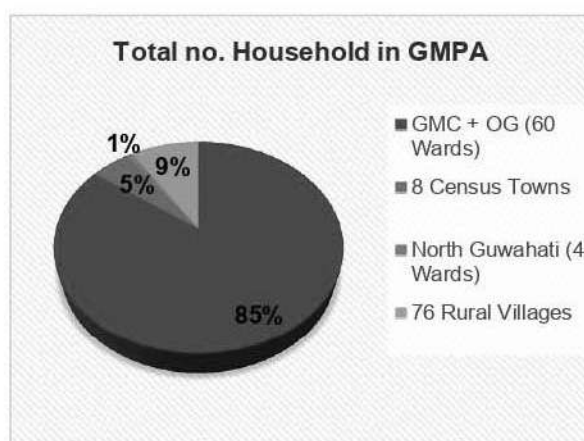


Figure 6-20: Total household in GMPA

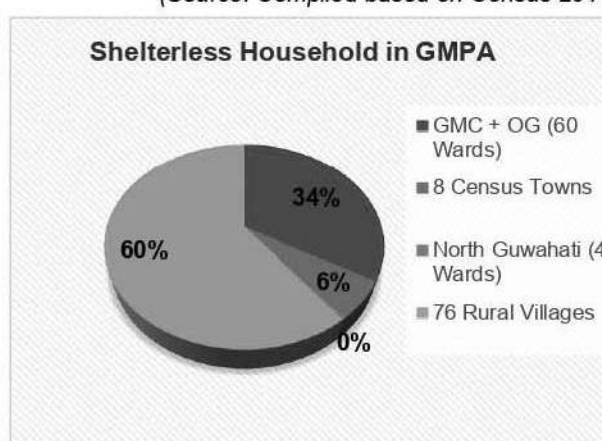


Figure 6-19: Shelter less household in GMPA

According to the housing shortage data it can be observed that majority of the households are residing in urban centers while only 9% of the total households are residing in rural areas. However, housing condition in urban region is livable. 34% of the total households are in livable condition situated in GMC+OG area hence all those households are considered as shelter less households, while in rural area significant number of houses are not livable. About 60% of the total shelter less households are in rural region of GMPA.

6.7 Slums & Informal Settlement

A Slum, for the purpose of Census, has been defined as residential areas where dwellings are unfit for human habitation by reasons of dilapidation, overcrowding, faulty arrangements and design of such buildings, narrowness or faulty arrangement of street, lack of ventilation, light, or sanitation facilities or any combination of these factors which are detrimental to the safety and health. According to Census, slums are categorized into notified and identified slums. The high rate of growth of urban population and its accumulative nature with a population has led to increasing problem of housing, reducing privacy and overcrowding in small house, steady growth of slums and unplanned settlements and severe effect on civic services in urban areas in the system.

Slums can be commonly seen in urban areas which are occupied by urban poor or economically weaker sections of the society or the migrants from nearby villages or other states that come to the urban areas in search of employment in order to earn their livelihood. Slums are an indispensable part of our cities because as the cities grow, due to economic and physical growth of the urban area, people migrate from different areas in search of employment. So, to provide basic amenities to the urban poor and slum dwelling people this aspect needs to be incorporated while doing urban study to have an overall development of the city. Planning is for the people and in a way, slums are an indispensable part of the society. To make the city livable for all and to improve the condition of slums, this comprehensive study regarding slums plays a vital role in planning.

6.7.1 Slums

The Census of India, 2011 has proposed to treat the following as 'Slum' areas:

- All notified areas in a town or city notified as 'Slum' by State, UT Administration or Local Government, Housing and Slum Boards etc. under any Statute including a 'Slum Act' are considered as Notified Slum.
- All areas recognized as 'Slum' by State/Local Government, UT Administration, Housing and Slum Boards etc., which may have not been formally notified as slum under any statute are categorized as Recognized Slum.
- A compact area of at least 300 populations or about 60-70 households of poorly built congested tenements, in unhygienic environment usually with inadequate

infrastructure and lacking in proper sanitary and drinking water facilities in the State/UT are categorized as Identified Slums.

Urban areas have potential to provide employment to a vast magnitude and attract many people. Many of them stay in slum colonies for the lack of a better alternative. Slum-dwellers stay in shanty structures in unhygienic environment, not by choice but by compelling circumstances as they were thrown out of the formal housing sector, the latter being expensive and much beyond their income levels.

Formal sector housing, including formal sector rental housing, is unaffordable to the urban poor. The Assam State Housing Board (ASHB), which was established in 1974, has built a total of 1,824 rental-housing units at several locations in the city. This involves Economically Weaker Section (EWS), Low Income Groups (LIG) and Middle-Income Group (MIG) units for Class III and IV government employees, including retired employees.

Research at one of the sites revealed that many of ASHB's EWS and LIG rental units are taken up by non-poor families. As a result, the urban poor and low-income groups have turned to the informal land and housing sector, including the informal rental sector. Location of economic activities and availability of land are important factors affecting the growth and distribution of the informal settlements of the poor in the city. Informal housing sector into several housing submarkets:

- Informal occupation (dakhal) of public and private lands,
- Settlements on Railway lands,
- Settlements on the State government's Revenue lands (which are in the plains, on swampy lands and in the hills),
- Settlements on the State government's Reserve Forest (RF) lands (which are mostly in the hills), private lands earmarked for acquisition and other private lands.
- Through alienation of land, there are commercial informal subdivisions of private agricultural lands on the city's periphery.
- Rental housing is found in all these sub-markets to a greater or lesser degree. 46% of dwelling units in Guwahati are rented, and a large proportion of these are likely to be in these informal settlements catering to the urban poor and low-income groups.
- As mentioned, the poor as well as the middle class have done dakhal to access land in Guwahati. While the informal settlements of the middle class consist of good

quality housing and basic services, many of the informal settlements of the poor consist of poor-quality housing and basic services. The level of services mostly depends on community mobilization through the formation of unnayan samitis, and often also political patronage.

6.7.2 Reason for Slum

The Guwahati region presents a wide range of activities in various institutional, Commercial and tourism sectors. Growth in such activities, possibilities of absorption in various service sectors, scope of employment in trade and business activities, hawking, retailing, carting etc., could have attracted more rural poor to the urban. Due to their economic status, these urban poor are unable to get a house within their limited income and hence occupy vacant spaces wherever available and lead a marginal level of living. These habitations in due course develop into slums proliferate exponentially further due to rapid urbanization and natural growth of population. In this scenario, the role of Government in tackling the slum becomes more pertinent.

6.7.3 Criteria for Slum Identification

- “A slum is a compact settlement of 10-15 households (for North-Eastern and special category State) with a collection of poorly built tenements, mostly of temporary nature, crowded together usually with inadequate sanitary and drinking water facilities in unhygienic conditions”.
- Tenure status of slum households: Insecure tenure households are more vulnerable, hence will be implemented on priority basis.
- Ownership of Slum: Guwahati Municipal Corporation owned land slum will have more priority than other ownership.
- Willingness of the slum Community gathered through FGDs/ Community level meeting etc.
- The location is prone to waterlogging, accumulation of drainage/wastewater etc.
- At least 50% of the dwelling units are of semi-permanent or non-permanent and kutcha in nature.
- Inadequate piped water supply.
- At least 50% of the households do not have individual household latrines.
- At least 50% of the households do not have access to private bathing spaces.
- At least 50% of the households do not have at least 1-metre wide pathways leading to their dwelling units.
- There is no street lighting in the cluster.
- At least 20% of the families do not have authorized electricity connection.

6.7.4 Impact of Slum

The development of slums leads to Poor environmental conditions in such areas which lead to poor health, which aggravates poverty and often results in lower educational levels, as well as loss of income owing to sickness, disease, and increased spending on health care, which may deplete household savings. On the other hand, environmental problems exacerbate urban poverty and poor neighbourhoods suffer disproportionately from inadequate water and sanitation facilities and indoor air pollution. Poor people living in slum are often forced to live in environmental unsafe areas, steep hillsides and flood plains or polluted sites near solid waste dumps, open drains and sewers, and polluting industries. Conflicts like quarrel, clash and fight in the squatters of this area is a regular phenomenon. This creates noise and violence which leads to lack of security in the area and disturbs the city dwellers, particularly the nearby residents, office workers, and school children. Besides, many of the residents are involved in prostitution, drug trafficking, hijacking, smuggling etc. These activities threaten the social and cultural environment of the city.

6.7.5 Slums in GMPA

As per Census 2011, there are 1,39,296 persons living in slums within GMC and OG area which is approximately 12%.

Table 6-22 Percentage of slum population from total population

Town Name	Total Population of Town	Slum Population	Percentage share from total population (%)
GMC + OG (60 Wards)	11,45,540	1,39,296	12.16%

(Source: Compiled by Consultant)

6.7.6 Notified and Non-notified Slum

Areas notified as slums by the respective municipalities, corporations, local bodies or development authorities are treated as “notified slums”. In any city, it is generally observed that the slum is developed mostly near their working places. Slum dwellers first prefer the location of land which is nearer to the workplace and then they prefer the location where basic amenities such as water, proximity to public transport etc. is available. That is why slums generally develop near the industries, wholesale-markets, go downs, railway stations and even in residential areas. They generally use public-transport or slow-moving vehicles such as cycle, rickshaws etc. as it is economical. Figure 6-21 shows the location of notified and non-notified slums across GMPA.

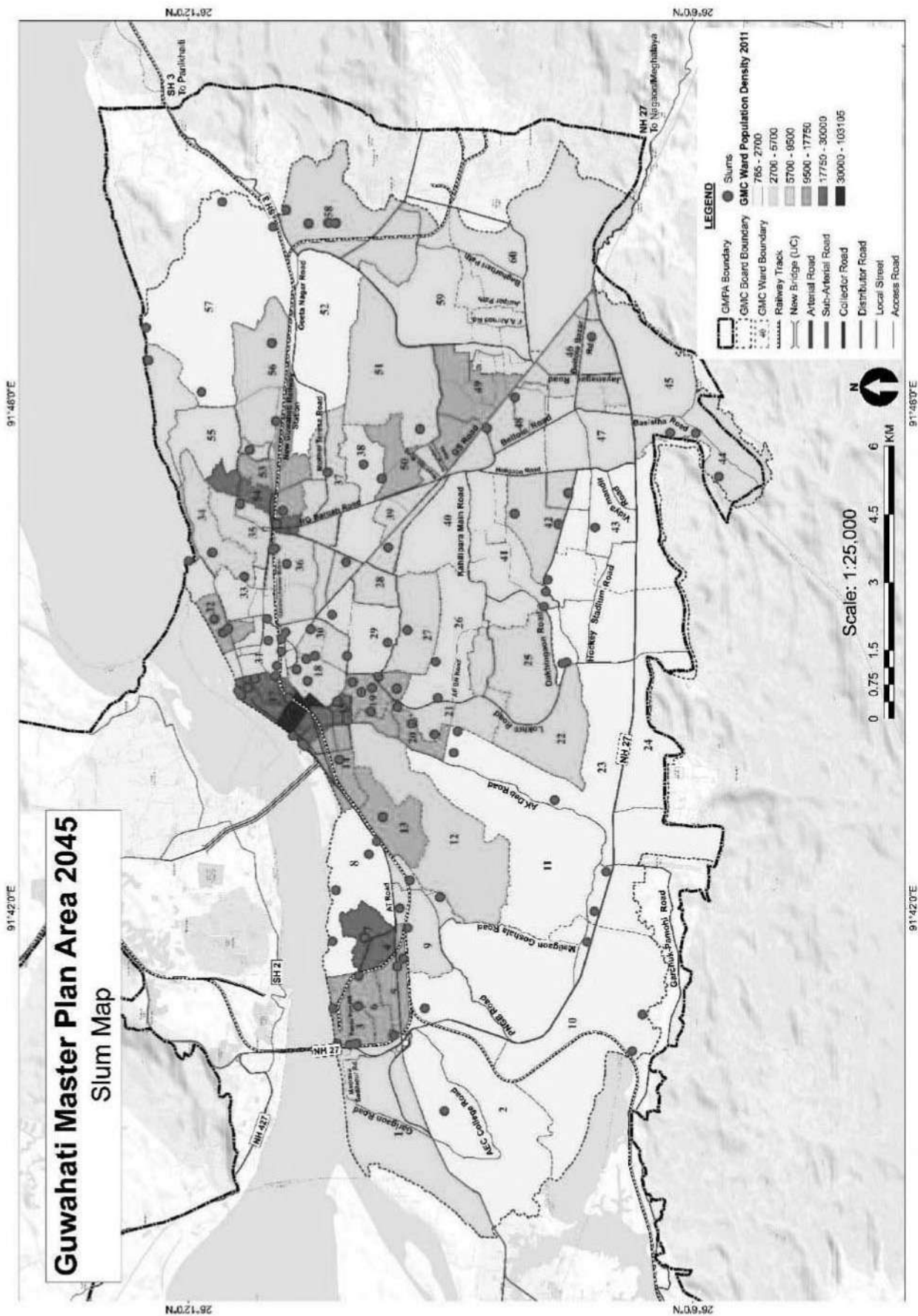


Figure 6-21: Slum Locations within Guwahati Municipal Corporation Area

The slums are situated within city area which are marked here in red color points and they are densely located near railway stations and railway tracks which indicates migration of people and availability of government land which are vacant, accommodating all these slums. The hygiene condition within slum area is degraded and major area is found with litters and thrown garbage. Open channel sewerage is a part of slum which also spills over with garbage at some places. Some patch of slum area along riverbank is non notified as they are accompanied by legal properties. Owing to slum area the premises is lacking in fundamental amenities of sanitation and hygiene. The area is on the rudimentary level of development.

The table 6-23 shows the details of slums which includes the name of slums, the land ownership status, total area, population, and number of households. According to the GMDA data, there are 99 notified slums in the town and 118 non-notified slums.

6.7.6.1 *Slum Types in Guwahati*

Type 1: Slums on vacant land adjacent to the railway tracks.

These slums are on vacant land adjacent to the railway tracks where the vacant land adjacent to the railway tracks are narrow strips of land (for example, between Lakhtokia gate number 1 to gate number 5),

Type 2: Slums inside railway colonies.

The second type of slums on railway land is the hutments that have been made in the Railway Colonies, on the vacant lands of the colonies (for example, in the Railway Colonies in Bamunimaidan and Gotanagar).

Type 3: slums on large parcels of railway land that are not located near any railway track.

The third type comprises of slums on large parcels of railway land that are not located near any railway track. Evictions have not taken place in these slums since quite many years although there is fear amongst some residents that evictions might take place some day because of the landownership (for example, Shakuntala Colony and Kailash Nagar in the Pandu area)

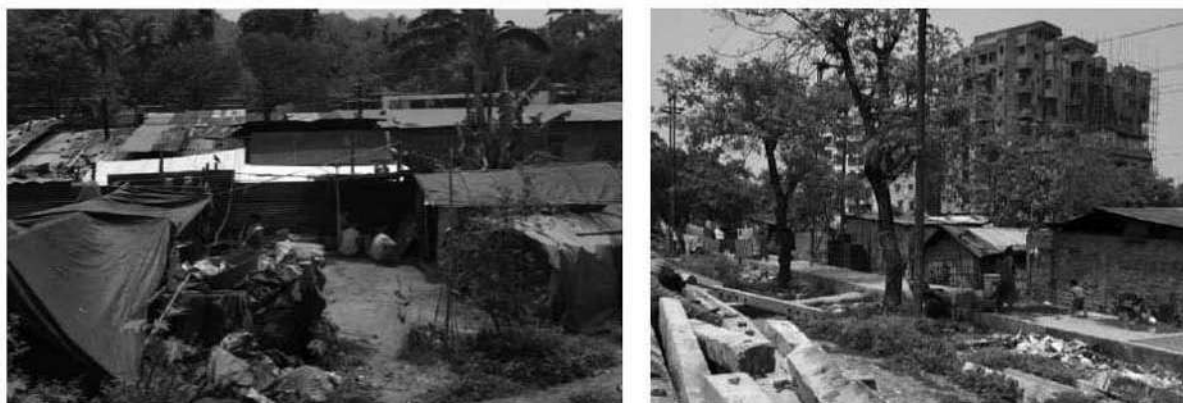


Figure 6-22: Slum Housing Near Railway Track

Table 6-23: Slum Population and Housing Details

Sr. No.	Name of the Slum	Ward No.	Slum Population	No. of Slum House hold
Notified Slum				
1	Nepali Patti	3	300	60
2	4 No. FG Colony	3	2000	400
3	Pandu 6 No. Colony	3	3500	700
4	Institute Colony	3	2500	500
5	Rest Camp Horizon Colony	4	1500	250
6	Rest Camp Shuttle Gate	4	1150	200
7	Shakuntala Kailashnagar Colony	5	3000	600
8	Sakuntala Colony	5	1200	225
9	Pub Boripara Dahpara	5	600	100
10	Harijan colony at pandu cabin area	6	3000	600
11	Temple Ghat	7	1200	200
12	Pachim Kamakhya Gaon	7	1200	200
13	Maligaon Shuttle Gate Zupad Patti	8	175	35
14	East Gotanagar	9	150	25
15	Bhutnath Milannagar Dolki	11	3500	600
16	Devakatanagar	12	178	67
17	Sankar Dev Nagar	12	73	21
18	Mitha amtol nagar	12	127	43
19	Garopara hill area	12	63	18
20	Manasha Nagar	12	150	30
21	Krisnagar hill side	12	93	32
22	Ambikagiri nagar	12	41	13
23	Santipur hill side	12	611	138
24	Gosaigaon	12	63	19
25	Dhirenpara Datalpara Area	12	117	27
26	Dhirenpara Himagiri Path 1	12	64	12
27	Dhirenpara Himgiripath 2	12	78	15

28	Sudarsan Nagar	12	167	46
29	Kalyan Nagar	12	1860	350
30	Jaya Nagar	12	53	17
31	Ramkhe nagar	12	725	175
32	Katabari Boro Basti	12	31	12
33	Gorchuk Batorbari	12	36	11
34	Mathura nagar	12	231	65
35	Fatashil Bishnunagar	12	550	180
36	Katabari area	13	48	16
37	Deven khaklai path	13	500	104
38	Fatashil majid goli	14	76	19
39	Fatasil Harijan Coloney	14	95	18
40	Motinagar Ganpat Nagar	15	500	95
41	Dakhingaon	16	450	65
42	Lalmati	17	680	160
43	Lokhara	17	415	100
44	Chagalpara	17	171	40
45	Sonkuchi	17	297	75
46	Machkhowa TRP Road	19	153	28
47	Kumarpara Railway line	19	49	12
48	Bishnupur	20	400	50
49	Kalapahar Hill Side	21	72	15
50	Mahendra Nagar	21	68	14
51	Shankarpur	21	120	25
52	Bimala Nagar	21	147	32
53	Kahilipara Hill Side	22	725	181
54	Power House Narakasur	22	71	15
55	Anandanagar Horizon Colony	24	4400	450
56	Narakhakhur Hill Side	24	10000	1500
57	ITI Backside	27	1200	110
58	Dalit Bikash Basti	28	250	30
59	Lakhtokia railway Side	30	200	30
60	Police Reserve Basti	30	300	50
61	Arikati Basti	34	900	85
62	Uzanbazar Railline Basti	34	350	50
63	Uriya Basti	34	200	30
64	Uzanbazar Horizon Colony	34	280	60
65	Uzabazar Islam Patty	34	600	130
66	Jahazghat River Side	34	300	30
67	Bonkonwer Nagar Kharguli	34	250	60
68	Islampur Colony	36	1300	100
69	Punjabi Colony	36	1200	150
70	Telegu Colony	36	1500	125
71	Nijarapar Hill Side	37	1000	150
72	Kailashpur	37	1200	180

73	Bapuji Nagar Uria Basti	37	600	80
74	Akashi Nagar	40	150	25
75	Bhaskar Nagar Basti	41	6500	1200
76	Anil Nagar Basti	42	278	48
77	Bengali Basti	37	250	50
78	Krishna Nagar	44	1000	260
79	Darbhang Basti	45	1800	300
80	Pub Bhaskar Nagar Pt-1	45	1700	320
81	Pub Bhaskar Nagar Pt-2	45	3000	600
82	Pukhudipar	45	1100	200
83	Railway Gate-6	45	1000	200
84	Sunchali	46	750	150
85	Anukul Basti	46	1000	200
86	Karbon gate	46	625	125
87	Ananda Nagar	47	1200	250
88	Siv Nagar	48	750	150
89	Lala Basti No-2	52	300	60
90	Babu Bast I-II	52	240	60
91	Satgaon Nowapara No.3	54	220	50
92	Mazar Ilaka Garo Basti	54	1500	370
93	Trinayan Nagar Basti	55	1930	411
94	Barpathar Near Basistha Tample	58	407	100
95	Bihari Basti Pragati nagar 1	60	30	15
96	Miyajan Nagar Basti	60	100	30
97	Shah Nagar Green Path-2	60	35	11
98	Pragati Nagae Basti	60	40	17
99	Natbama Mazar Bazar	60	199	49
Total			87,457	15,701
Non- notified Slum				
1	G.U BKB Sweeper Colony	2	300	60
2	New Colony Sheal Patty	3	3000	600
3	Dhakai Patti	3	5000	1000
4	Anandanagar jabarbasti	6	600	100
5	West Kamakhya Colony	7	330	55
6	Temple Ghat River side	7	120	20
7	Nag Colony	7	132	22
8	Puran Bazar	7	300	50
9	Gate No.1 Bihari Patti	7	500	100
10	Mission Para	7	200	40
11	Punjabi Kamakhya Colony	7	100	20
12	Maligaon Railway Line-1	9	250	30
13	Garokhuli Nizarapar	10	120	25
14	Bapuji Nagar	10	132	22
15	Madhabdev Nagar Nalapar	10	90	15
16	Kalipur	11	900	150

17	Bhutnath Bagan	11	1500	300
18	Nursery Nabarun Nagar	11	150	25
19	Baro basti	12	68	21
20	Dhirenpara 1	13	42	10
21	Dhirenpara 2	13	45	13
22	Milan path	13	32	10
23	Fatashil mahendra nagar	14	205	40
24	Fatashil Madhupur	14	36	11
25	Milan Path (Dhiren Para)	13	127	32
26	Milan path 2	13	39	12
27	Dhirenpara 2	13	36	11
28	Dhiren Para Masjid Gali	13	70	15
29	Dhiran para 5	13	74	23
30	Dhirenpara 6	13	33	10
31	ISBT slum	13	49	14
32	Milon Path Dhirenpara	13	33	16
33	Panjabi old coloni	14	180	30
34	Madhabpur mahendranagar	14	132	27
35	Majid Gali	14	53	21
36	Itabhataschool masjid gali	14	38	11
37	Masjid gali (b) itta bhatta	14	56	11
38	Dhirenpara Masjid gali©	14	33	10
39	Masjid gali(d)	14	42	14
40	Ittabhata Kawariya	14	46	17
41	Ita Bhatta	14	47	11
42	Adimgiri Path	12	4100	716
43	Adimgiri	12	59	17
44	New Basti Area	12	36	11
45	Cheniram Kachari Path	12	61	14
46	Datapara New Basti Hill Side	12	128	32
47	Dhirenpara Pradeep Khaklari Path	13	47	11
48	Katabari khasiya Ram Boro path	13	54	17
49	Dhirenpara Milan path	13	38	10
50	Dhirenpara	13	44	12
51	Tapang Kachai Path	12	110	22
52	Santi Path	12	135	28
53	Adgiri Path	12	2400	600
54	Sudarsan path	12	131	38
55	Udalbakra Rodalipath	16	220	40
56	Kumarpatty Railway Line	18	138	21
57	Birubari Hill Side	23	15000	3000
58	Ram Krishna Mission Road	25	250	40
59	Jonakpur Basti	25	450	100
60	Rupnagar ASTC Colony No.1,2	26	420	45
61	Rupnagar Bharalupar	26	200	15

62	Rehabari Milonpur	27	150	20
63	Rehabari A.K Azad Road	27	100	15
64	Tokobari A.T Road	28	120	20
65	Athgaon Kheti Joymati Road	29	100	15
66	Railway Side Basti	31	250	30
67	Nabis Nagar	32	220	40
68	Manipuri Basti Bihari Patty	32	200	30
69	Nepali Basti	32	200	30
70	Rupnagar Horizon Colony	26	250	30
71	Malibagan Kachari Basti	35	130	30
72	Guwahati Club	35	230	35
73	Chennikuthi	35	100	20
74	Chenapati Colony Railway Side	36	1000	120
75	Gandhibasti Tinali	36	40	10
76	Krishna Nagar Christan Basti	38	250	25
77	RudraNagar	38	380	40
78	Gandhi Mandap	39	150	30
79	Maila Tanki	45	700	150
80	Santi Nagar	49	600	105
81	Jonaki Nagar	49	300	60
82	Hazan Basti	49	300	60
83	Islam Nagar	49	500	100
84	Bakulpur	49	250	45
85	Bhupendra Nagar	49	900	180
86	Saru Motoria Masjid Basti	51	200	50
87	Saru Motoria Basti Sunali Enterprise	51	200	50
88	Saru Motoria Nandan Nagar	51	110	24
89	Saru Motoria S1	51	44	11
90	Bortila Hill Area	51	240	60
91	Pathar Quari Basti Prt-I	51	1800	450
92	Mathgaria Rail Line Basti	52	160	40
93	Dwarandha-I	52	64	16
94	Dwarandha-II	53	64	16
95	Dwarandha-III	53	100	25
96	Dwarandha-IV	53	52	13
97	Dwarandha-V	53	80	20
98	Dwarandha-VI	53	81	27
99	Dwarandha-VII	53	100	25
100	Dwarandha-VIII	53	100	25
101	F.A Ahmed Nagar Basti	53	72	18
102	Panjabari Namghar Path-03	54	60	15
103	Panjabari Namghar Path-02	54	124	31
104	Panjabari Namghar Path-01	54	64	16
105	Satgaon Railway Line Kalyankuchi	52	100	25
106	Maidan Gaon Basti	55	300	70

107	Patharkuchi Kainadhara Slum	56	52	24
108	Bongaon MaziparaJanpar Basti	58	64	26
109	Hatigaon Sanjogi Path No 1 Basti	58	25	15
110	Bhetapara Dolong Basti	58	60	26
111	Indranagar Madhabpur Janpar Basti	58	455	90
112	Dakhin Gaon Tiniali Basti No.1	59	115	36
113	Dakhin Gaon Basti No.2	59	60	20
114	Dakhin gaon Tiniali Basi	59	35	17
115	Notboma Basti	60	40	15
116	Notboma Housefed Nadipar Basti	60	97	17
117	Bihari Basti Pragati Nagar 2	60	20	13
118	Shah nagar green path Basti 1	60	20	10
Total			51,839	10,389
Grand Total			1,39,296	26,090

(Source: GMDA, Guwahati)

The following table 6-24 provides the details of Slum housing Condition in Guwahati City

Table 6-24: Slum Census Houses

Sr. No.	Area Name	GMC + OG
1	Total number of Slum Census houses	26090
2	Total number of occupied Slum census houses	23481
3	Total number of vacant Slum census houses	2087
4	Total number of occupied locked Slum census houses	522

(Source: Compiled by Consultant)

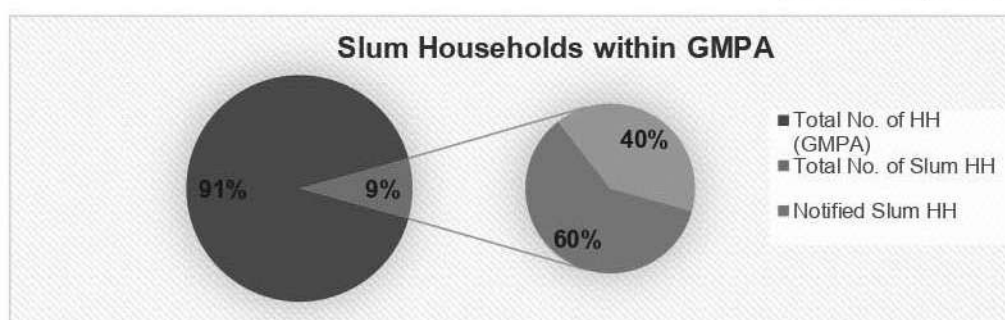


Figure 6-23: Slum household number within GMPA

The above figure represents the percentage share of slum households out of total households within GMPA. Within GMPA slums are majorly located within vacant public land in core city region. Presently about 217 slums are located within different wards of GMC. Approx. 9% of the total households residing in slums, out of which 15701 households are notified slum households about 40% of the total slum households and almost 60% of slum households are still non-notified. The following table indicates the current condition of housing condition within slum areas.

6.7.7 Issues in Slum Housing

- Dilapidated temporary housing structures

In GMPA near core commercial areas, railway colonies and near railway station where slums area located observed to be in dilapidated condition, incapable for providing shelters to slum dwellers.

- Inadequate Sanitation Facility

Slum dwellers do not have proper water supply facility individually or within closed proximity however they are dependent on other households, commercial areas located closed to slum areas.

- Absence of Individual toilets

Sanitation is one of the major concerns in these slums. In GMPA majority of the slums are not having individual latrines and bathrooms, although they are dependent on community toilets which are also not found to be in good condition.

- Irregular Waste Disposal in surrounding

Majority of vacant lands within slum area remains contaminated with wastes and garbage dumps, and no internal waste collection practices observed. Moreover, dwellers have habit of haphazard waste dumping either due to inadequate number of community dustbins, insufficient waste collection practices or their individual attitude towards sanitation.



Figure 6-24: Poor Drainage Condition near Slums



Figure 6-25: Poor Sanitation Facilities in Slums

6.7.8 Slum Development/Improvement Programmes

6.7.8.1 *National Slum Development Programme*

The components of this program include:

- Provision of physical amenities like water supply, storm water drains, community bath, widening and paving of existing lanes, sewers, community latrines, streetlights, etc.
- Community Infrastructure: Provision of Community centres to be used for pre-school education, non-formal education, adult education, recreational activities etc.
- Community Primary Health Care Centre Buildings to be provided.
- Social Amenities like pre-school education, non-formal education, adult education, maternity, child health and Primary health care including immunization etc.
- Provision of Shelter: The scheme has a component of shelter up-gradation or construction of new houses as may be required.

6.7.8.2 *Concept of City Without Slum*

The Asian Development Bank through a study have worked out comprehensive guidelines for the program – ‘**City Without Slums**’. One of the major objectives of such a program is eradication or significant reduction of poverty of urban areas. Beside this, the other objectives are to ensure the following:

Security of tenure,

- Minimum acceptable standards of municipal infrastructure and social services,
- Improved employment and income earning opportunities,
- Improved education, skills, training and health care,
- Better access to credit and other financial services for house/plot purchase, home improvement, enterprise development and livelihood activities,
- Improved level of community organization capacity and empowerment.

6.7.9 Government Initiatives for Slum Free City

The most recent programme for housing for the urban poor was JNNURM's submission of Basic Services to the Urban Poor (BSUP). Under this, three sites were proposed for construction of housing for the urban poor: Fatasil, Morasoli and Amingaon. Only the Morsali site has been completed where GMC built 128 dwelling units. In Fatasil approximately 400 dwelling units have been constructed so far against the proposed 1,104 dwelling units. In Amingaon, where 1,028 dwelling units were to be built, construction work has not even been started. The dwelling units at Morasali and Fatasil have been allotted to the GMC Class IV employees who used to earlier live in dilapidated houses and hutments on the same land. Slum free city planning is now being done under Rajiv Awas Yojana (RAY), the flagship scheme of the Ministry of Housing and Urban Poverty Alleviation (MHUPA). The GMC's 2012 slum survey was done with the purpose of preparing a Slum Free City Plan of Action under RAY.

However, the very slow progress on RAY so far suggests that it will not help the urban poor much.

6.7.9.1 Previous Schemes

There is no codified policy for "Affordable Housing" but initiative has been taken by the government to produce the stock through various Housing Schemes which are implemented in the state under MoHUA, the erstwhile MoHUPA.

Central Programmes:

1. **Integrated Housing & Slum Development Programme (IHSDP):** Under this scheme, 263 DUs were sanctioned of which 2962 DUs have been constructed. Remaining 301 DUs are being constructed.
2. **Basic Services for Urban Poor (BSUP):** Total households sanctioned, as on date, under this scheme is 2260, out of which 416 DUs have been constructed and remaining 1844 DUs is in process. 416 DUs have been occupied by the end users.
3. **10% Lump sum Provision for development of North-Eastern States:** This scheme is especially formulated for the development of North-Eastern States for which GoI has earmarked 10% for all Ministries Budget. Total 19 Projects were sanctioned under the scheme with the total project cost of Rs. 10736 lakhs for

producing affordable housing, vendors market, multi-utility building and rehabilitation centres for hawkers and vendors.

4. **Rajiv Awas Yojana (RAY):** Guwahati received Rs. 76.34 lakhs for slum survey, mapping, developing slum information system, community mobilization, slum free city/state plans etc. The technical cell has been established at the state level and ASCI is selected to prepare the State Plan of Action.

State Schemes:

1. **Assam State Housing Board Schemes:** In Guwahati, most of the public housing constructed by ASHB is through its rental housing schemes for Grade III and Grade IV government employees (including for those retired from such employment).
2. **Janata Housing Scheme:** In Janata housing scheme a maximum financial assistance amounting to Rs. 25,000/- is provided, for construction of house, out of which Rs. 19,000/- is loan and Rs.6000/- is subsidy. The payment of loan and subsidy is to be made in three instalments on the basis of progress of construction. The repayment period of loan with interest is 10 years in equated monthly installment.
3. **Apun Ghar Home Loan Scheme:** Under the Apun Ghar scheme, the state government would provide housing loans at a subsidized rate of 5% for its women employees and 5.5% for men employees. The loan would be provided without any collateral security and processing fee. Under the Apun Ghar scheme, the state government employees can avail a loan of up to Rs. 15 Lakh with an interest subsidy of 3.5%. The subsidy on interest rates would benefit state government employees in terms of lower interest rates and lower EMIs.
4. **Rental Housing Scheme for Grade III and Grade IV Government Employee:** The rental housing scheme is a continuing scheme under State Plan allocation. The main objective of this scheme is to construct various types of low cost multi-storied R.C.C buildings category-wise to provide subsidized rental accommodation to Grade III and Grade IV Government employee on the ASHB's own land in different places of Assam. As on date, ASHB has built housing at several locations for a total of 1824 household on a rental basis. This includes flats for EWS, LIG and MIG households as well as Assam-type housing.

5. **HUDCO finance for Composite housing schemes:** Provide financial assistance in terms of loan only in category wise i.e. HIG, MIG, LIG and EWS with HUDCO finance. Beneficiaries submit application to Assam State Housing Board and the same is submitted to HUDCO for sanction. In this regard GoA has to stand guarantor for the purpose of sanctioning of loan.
6. **Project under Non-Lapsable Central Pool Resources (NLCPR):** Under this scheme the GoI has accorded Rs. 8.21 crore and Rs 53.18 crore under NLCPR for construction of 180 units and 640 units respectively for urban poor. The construction work of 180 units has been completed and allotted while the construction of 640 units is entrusted to National Building Construction Corporation (NBCC). 320 units out of 640 are constructed and allotted. After completion of remaining 320 units the same will be utilized for rental accommodation purpose to the LIG category people.

(Source: Assam Urban Affordable Housing Policy, 2020)

6.8 Housing Demand Gap Analysis

6.8.1 Factors causing Housing Shortage

There are several factors which would affect the housing shortage. The recent technique in finding the housing shortage is published by Ministry of urban poverty and alleviation. There are 5 major factors which decides the housing shortage in the system. They are,

1. Congestion factors
2. Obsolescence factors
3. Non-Durability
4. Housing shortage
5. Calculation of housing shortage for 2045 for the projected population

6.8.1.1 Congestion Factor

Congestion factor is the ratio of households that are residing in unacceptable congested conditions, from physical and socio-cultural viewpoints (i.e. married couples sharing the room with other adults etc.,) or the percentage of households in which each married couple does not have separate room to live. The table 6-25 indicates that the congestion factor within GMPA according to the census 2011. It is observed that the Urban area shows a uniform congestion factor in Guwahati for the year 2011.

Table 6-25 Household without exclusive room

Sr. No.	Guwahati Planning Area	HH 2011	No exclusive room for marriage couples 2011	Congestion Factor
1	GMC + OG (60 Wards)	2,30,769	3974	0.017
2	8 Census Town	13622	136	0.010
3	North Guwahati (4 Wards)	2294	28	0.012
4	76 Rural Villages	24,540	49	0.002
Total for GMPA		2,71,225	4,187	0.015

(Source: Compiled by Consultant)

6.8.1.2 Obsolescence Factor

Obsolescence factors is all the bad houses, excluding those that are less than 40 years old and all houses' ages 80 years or more. Obsolescence are the households living in obsolete buildings (40 to 80 years old in a bad structural condition, and 80 or more years) and excluding temporary houses (to avoid double counting).

The table 6-26 illustrates the Obsolescence Factor for Guwahati Planning Area according to Census 2011.

Table 6-26 Housing shortage due to obsolescence

Sr. No.	Guwahati Planning Area	HH 2011	HH above 50+ yrs. in GMPA	Obsolescence Factor
1	GMC+OG (60 Wards)	4615	4615	0.02
2	8 Census Town	545	545	0.04
3	North Guwahati (4 Wards)	46	46	0.02
4	76 Rural Villages	1227	1227	0.05
Total for GMPA		2,71,225	6433	0.02

(Source: Compiled by Consultant)

The table reveals that the highest obsolescence factor is observed in rural and in census town area which indicates that the status of housing condition is poor with respect to the overall housing condition of the Guwahati Planning Area. It is also observed that the lowest Obsolescence factor is in GMC and in North Guwahati area which also witnesses the good quality of socio-economic status in the region mainly due to the urban nature of the area and developments which are in tune with the overall development of the Guwahati region.

6.8.1.3 Non-Durability

Non-durability is the no. of temporary houses which are not suitable for living or non-serviceable units are taken out. Temporary/ kutcha houses are those in which both the walls and roof are made of materials that need to be replaced frequently. As per the census definition, temporary houses are made with walls and roofs made of temporary material. Walls can be made of grass, thatch, bamboo, plastic, polythene, mud, unburnt bricks or wood. Roofs can be made of grass, thatch, bamboo, wood, mud, plastic or polythene. Hence the non-durability of housing is the difference between the number of housing stock to the number of permanent houses. The table 6-27 represents the details of permanent, semi-permanent house and temporary house within the GMPA.

Table 6-27 Housing shortage due to non-durability

	Particular	Permanent	Semi-permanent	Temporary	Number of Housing Stock
Urban	GMC+OG	1,75,384	53,077	2308	230769
	8 Census Towns	8718	4,768	136	13622
	North Guwahati (4 Wards)	1514	757	23	2294
Rural	76 Rural Villages	8,589	12025	3926	24540
Total		1,94,205	70,627	6393	271225

(Source: Compiled by Consultant)

6.8.2 Existing Housing Shortage

Acute housing shortage in country specially in urban centres has become a burning problem of the day since house construction activities do not keep pace with the growth of population of urban centres. The number of houses has, therefore, been successively falling short of actual requirement of the urban population.

Based on the Ministry of Housing and Urban Poverty Alleviation, National housing shortage, the final estimation of housing shortage is calculated based on the corresponding factors such as homeless population, Non-durability factor, Congestion factor, Obsolescence. It has been calculated based on the census 2011. For this exercise, the following assumptions were adopted with the reference to the Assam state, District and GMC Housing Profile based on Census 2011 housing data:

- Dilapidated houses accounts for 3% of total housing stock for the project area and 3.5% for the urban areas.
- Vacant houses accounts for approx. 8% of total housing stock for the project area and almost 10% for the urban areas.

The details of housing shortage based on census 2011 data are presented in the table

Table 6-28 Total Housing Shortage in GMPA

Sr. No.	Housing Shortage	Household Shortfall
1	Shortage due to Homeless Population	6393
2	Shortage due to Dilapidated Houses	8,212
3	Shortage due to Vacant houses	21,608
4	Shortage for Slum households	26,090
5	Shortage due to congestion in 2011	4187
6	Shortage due to obsolescence in 2011	6433
Total Housing Shortage (2011)		72,923

(Source: Compiled by Consultant)

6.9 Housing Demand Projections

The future housing requirement for GMPA has been assessed considering both, the quantitative housing shortage, and the qualitative housing shortage. Below mentioned is the quantitative calculation of future housing requirement for year 2045.

Table 6-29 Decadal additional housing requirement

Year	Additional Population	HH size	Additional HHs
2021	333952	4.2	79512
2031	548915	4	137229
2041	1126884	4	281721
2045	712362	4	178091
Total Additional Housing Requirement till 2045			676553

(Source: Compiled by Consultant)

For the 2021 housing projection considered average household size is 4.2; while for 2031, 2041 and 2045 projection 4 household size is considered, based on the assumptions of having more numbers of nuclear families in the future than today and constant household formation rate for the entire Planning Area. The projected additional housing requirement considering increase in population by 2045 is 6,76,553.

Table 6-30: Total Housing Demand by 2045

Sr. No.	Particulars	Numbers
1	Region	GMPA
2	Total Population 2011	1141699
3	Total Household	271225
4	No. of Housing Stock 2011	264832
5	Housing Gap (Factor 1)	6393
6	No. of Good and Livable Houses Within GMC+OG	228857
7	No. of Dilapidated houses within GMC (Factor 2)	8,212
8	Congestion Factor 2011	0.015
9	Shortage Due to Congestion Factor (Factor 3)	4187
10	Obsolescence Factor 2011	0.02
11	Shortage due to Obsolescence Factor (Factor 4)	6433
12	No. of Locked and Vacant houses (Factor 5)	21,608
13	No. of Slum houses (Factor 6)	26,090
14	Projected Population 2045	3863812
15	Projected Increase in Population from 2011 to 2045	2722113
16	Housing requirement for increase in Population (Factor 7)	676553
Total Housing Demand – 2045 (Factor 1+2+3+4+5+6+7)		7,49,476

(Source: Compiled by Consultant)

6.10 Housing Provision

The housing provision is met can be accommodate in the proposed Residential, Mixed Use and Conservation zones. Further, the residential and mixed uses zones are divided into different categories; with each has various FSI to offer so the development intensity can be managed. It is proposed to facilitate the provision of a fully serviced dwelling unit for each family and reduce the gap between housing shortage and supply through suitable measures. The planned catering for the additional housing is as mentioned in table 6-31.

Table 6-31 Decadal housing provision in GMPA

Year	Additional Population	HH size	Additional HH	Catering for the Shortage	Total Housing Need (decade wise)
2021	333952	4.5	74211	27378(35%)	101589
2031	548915	4	137228	23468(30%)	160696
2041	1126884	4	281721	15645(20%)	297366
2045	712362	4	178090	11735(15%)	189825
Total			671260	78216	749476

(Source: Compiled by Consultant)

For the decade 2021, 35% catering for housing shortage has been considered by taking benefit of the different housing schemes and state-central government fund utilization. Similarly, 30%,20% and 15% catering for year 2031,2041 and 2045, respectively.

6.10.1 Housing Provision Based on Income Group

Table 6-32 Housing provision considering Income Group

Year	Total Housing Need (Decadal)	EWS 20%	LIG 30%	MIG 40%	HIG 10%
2021	101589	20318	30477	40636	10159
2031	160696	32139	48209	64278	16070
2041	297366	59473	89210	118946	29737
2045	189825	37965	56948	75930	18983
Total	749476	149895	224843	299790	74948

(Source: Compiled by Consultant)

As per the Ministry of Urban Poverty and Alleviation the population is categorised based on the income level such as Economically Weaker Section (EWS), Low Income Group (LIG), Medium Income Group (MIG) and High-Income Group (HIG). The table 6-32 indicates that the housing shortage for 2045 is calculated for each classification based on income level. This table helps to earmark the affordable housing in the Guwahati Planning Area and would also help to formulate the housing policy.

6.11 Housing Policy

The main objective of the housing policy for Guwahati Planning Area is not only to meet the housing demand by horizon 2045 but also to improve the residential conditions at large. In view of this, Master Plan proposes development of residential neighborhoods having adequate facilities within walk able distance. Design considerations require better planning.

6.11.1.1 *Private sector Participation*

Privatization must be encouraged by participation of individuals and developers in the house building activities. The local administration could provide land with offsite and on-site physical and social infrastructure and the private entrepreneurs could invest in house building. In principles, housing has four distinct components for its development i.e., Land Assembly, infrastructure provision, building construction and post occupancy management. The above diagram gives an idea how these activities should be distributed amongst the Government, private and cooperatives making the Government a facilitator for housing development.

6.11.1.2 *Role of Government*

Government has to play proactive role of promoting the housing industry by regulatory measures and acting as a watch-dog rather than fully involving its organs in the provision of shelter to the town inhabitants. The magnitude of housing shortage is enormous and the State on its own cannot provide the housing stock. Government will limit its role to development of serviced land and subsequently its release to private developers and Cooperative Societies on premium equivalent to the cost of land plus marginal profit with only advisory and regulatory role in the development of housing industry.

6.11.1.3 *Housing of Different Income Categories*

The Master Plan recommends identification of priorities in dealing with different segments of the population. Out of the total demand, income category wise demand has been given in fixing the priority in dealing with different segments of the population: H.I.G. and M.I.G. dwelling units shall be provided with only developed land at market price to cross subsidize the housing for E.W.S./L.I.G.

6.11.1.4 Group Housing Schemes

To meet the housing demand by 2045, based on the need housing colonies or townships can be developed. Economies of scale are favorable to large colonies because of reduced per capita on investment on infrastructure and services development in large colonies. The Master Plan also envisages smart growth of the city to overcome the scarcity of land and regulate sprawl of urban development in rich agricultural hinterland.

6.11.1.5 Urban Village

The peripheral village settlements, which have been incorporated in the Planning Area of Guwahati, are going to be part of its proposed Urban Area Limits during the process of its expansion. The settlements having a completely different life-style for centuries are now getting merged into urban environment and need a sensitive approach in the planning and development process. At present these settlements do not confirm to any urban character and need an 'Action Plan' for extension of water supply, sewerage and drainage facilities and other basic urban amenities and efficient linkages with the main city. The settlements should get the modern services and amenities and should also be catered for their traditional cultural styles.

6.12 Slum Upgradation Program

The scheme aims at acquiring sites in various parts of urban areas and to construct tenements and provide developed plots under "Sites and Services" concept to the slum dwellers. Improvement works to the existing Slums are being implemented through the Assam State Housing Board. The tenements in storeyed blocks are made available to the slum dwellers on rental basis. Apart from that, upgradation of slum areas by extending basic amenities viz., roads, water supply, sewerage, education, health, electricity, social infrastructure are also undertaken.

6.12.1 Pradhan Mantri Awas Yojana (PMAY)

The "Pradhan Mantri Awas Yojana (Urban) - Housing for All" was launched by Government of India with an objective of providing houses to every family by the year 2022. The Mission is being implemented during 2015-2022 and provides central assistance to Urban Local Bodies (ULBs) and other implementing agencies through States/UTs. The "Pradhan Mantri Awas Yojana (Urban) - Housing for All" has following four Sub-schemes giving options for beneficiaries, ULBs / Implementing Agencies and the State Governments:

1. In-situ Slum rehabilitation of Slum Dwellers
2. Credit Linked Subsidy Scheme.
3. Affordable housing in partnership with Public & Private sectors.
4. Beneficiary Led Individual House Construction or enhancement.

6.12.1.1 *In-situ Slum Rehabilitation of Slum Dwellers (ISSR)*

"In-situ" slum rehabilitation using land as a resource with private participation for providing houses to eligible slum dwellers is an important component of the "Pradhan Mantri Awas Yojana (Urban) – Housing for All" mission. This approach aims to leverage the locked potential of land under slums to provide houses to the eligible slum dwellers bringing them into the formal urban settlement. Slums so redeveloped should compulsorily be denotified.

Eligibility

- Slums, whether on Central Government land/State Government land/ULB land, Private Land, should be taken up for "in-situ" redevelopment for providing houses to all eligible slum dwellers.
- Eligibility of the slum dwellers like cut-off date etc. will be decided by States/UTs preferably through legislation.

Highlights

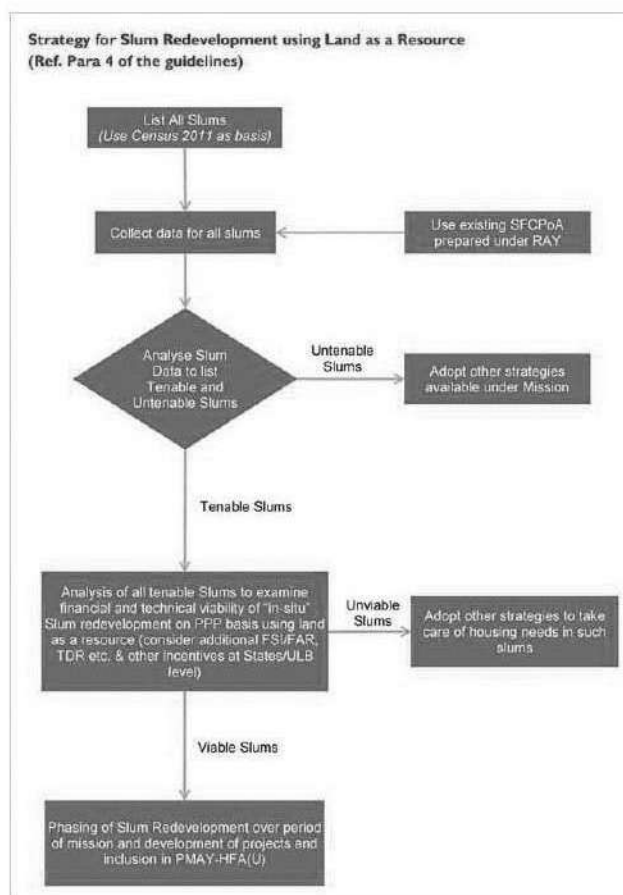
- Additional Floor Area Ratio (FAR)/Floor Space Index (FSI)/Transferable Development Rights (TDR) for making slum redevelopment projects financially viable.
- Slum rehabilitation grant of Rs. 1 lakh per house, on an average, would be admissible for all houses built for eligible slum dwellers in all such projects.
- Beneficiary contribution in slum redevelopment project, if any, shall be decided and fixed by the States/UTs Government.
- State/UT Governments and cities would, if required, provide additional Floor Area Ratio (FAR)/Floor Space Index (FSI)/Transferable Development Rights (TDR) for making slum redevelopment projects financially viable.
- States/UTs will have the flexibility to deploy this central grant for other slums being redeveloped for providing houses to eligible slum dwellers with private participation, except slums on private land. It means that States/UTs can utilise more than Rs. 1 lakh per house in some projects and less in other projects but within overall average of Rs. 1 lakh per house calculated across the States/UTs.

- The per house upper ceiling of central assistance, if any, for such slum redevelopment projects would be decided by the Ministry.
- States/UTs may decide whether the houses constructed will be allotted on ownership rights or on renewable, mortgageable and inheritable leasehold rights.
- States/UTs may impose suitable restrictions on transfer of houses constructed under this component.
- "In-situ" redevelopment of slums on private owned lands for providing houses to eligible slum dwellers can be incentivised by State Governments/UTs or ULBs by giving additional FSI/FAR or TDR to land owner as per its policy. Central assistance cannot be used in such cases.
- A viable project would have two components i.e. "slum rehabilitation component" which provides housing along with basic civic infrastructure to eligible slum dwellers and a "free sale component" which will be available to developers for selling in the market so as to cross subsidize the project.

Implementation/Approach for Slum Rehabilitation with Private Partnership is outlined as below:

- All tenable slums as identified in Housing for All Plan of Action (HFAPoA) of the city should be analysed with respect to their location, number of eligible slum dwellers in that slum, area of the slum land, market potential of the land (land value as per ready reckoner can be used), FAR/FSI available and density norms applicable to that piece of land etc..
- On the basis of analysis of slums, the implementing authorities should decide whether a particular slum can be redeveloped with private participation or not using land as a resource and to provide houses to eligible slums dwellers.

- For making projects financially viable, in some cases, States/UTs and cities might have to provide additional FAR/FSI or TDR and relax density and other planning norms. States/UTs may also allow commercial usage for part of the land/FAR as mixed usage of the land.
- States/UTs can also consider clubbing of nearby slums in clusters for in-situ redevelopment to make them financially and technically viable. Such cluster of slums can be considered as a single project.
- While formulating the project, the project planning and implementing authorities should also decide the area of slum land which should be given to the private developers. In some cases, the area of slum may be more than what is required for rehabilitating all eligible slum dwellers plus free sale component for cross subsidizing the project. In such cases, project planning authorities should give only the required slum land to private developers and remaining slum land should be utilised for rehabilitating slums dwellers living in other slums or for housing for other urban poor.
- Slum dwellers through their association or other suitable means should be consulted while formulating redevelopment projects especially for the purpose of designing of slum rehabilitation component.
- The private developers who will execute the slum redevelopment project should be selected through an open transparent bidding process. The eligibility criteria for prospective developers can be decided by States/UTs and ULBs. The scope of work of the prospective developers should be to conceive and to execute the project as mandated by the implementing agency using its financial and technical



resources. The project developers would also be responsible for providing transit accommodation to the eligible slum dwellers during the construction period.

- All financial and non financial incentives and concessions, if any, should be integrated in the project and declared 'a priori' in the bid document. These incentives and concessions should also include contribution from beneficiaries/slum dwellers, if any.
- Sale of "free sale component" of project should be linked to the completion and transfer of slum rehabilitation component to the implementing agency/state. Such stipulation should be clearly provided in the bid document to avoid any complication.
- Slum rehabilitation component should be handed over to implementing agency to make allotments to eligible slum dwellers through a transparent process. While making the allotment, families with physically handicapped persons and senior citizens should be given priority for allotment on ground floor or lower floors.
- Open bidding for the slum redevelopment project may result either into a positive premium or negative premium. In case of positive premium, the developer who offers the highest positive premium while satisfying all other conditions should be selected. In case of negative premium, the implementing authority may select the bidder proposing lowest negative premium. Funds required to make the project viable can be made available either from slum rehabilitation grant of Central Government or own fund of States and ULBs as well as positive premium received from other projects.
- Any private participation, that demands substantial grants from Government, may not be encouraged. Slums can either be taken up later for development or Kutcha/ unserviceable houses in such slums can be taken up under other components of the mission.
- States/UTs project planning and implementing authorities, ULBs should have a single project account for slum redevelopment project where positive premium, slum rehabilitation grant from Central Government, funds from State/UT Government or any other source is to be credited and used for financing all slum redevelopment projects with negative premium. Such accounts can be opened city-wise.

- Slum rehabilitation projects would require various approvals from different agencies as per prevailing rules and procedures in the States/UTs. Project development may also require changes in various development control rules. To facilitate such changes and for faster formulation and approval of projects, it is suggested that a single authority should be constituted with the responsibility to change planning and other norms and also for according approval to projects.

6.12.1.2 Credit Linked Subsidy Scheme for EWS/LIG (CLSS)

Pradhan Mantri Awas Yojana (Urban) - Housing For All Mission, in order to expand institutional credit flow to the housing needs of urban poor is implementing credit linked subsidy component as a demand side intervention.

- Beneficiaries of Economically Weaker Section (EWS) and Low Income Group (LIG) seeking housing loans from Banks, Housing Finance Companies and other such institutions would be eligible for an interest subsidy at the rate of 6.5 % for a tenure of 20* years or during tenure of loan whichever is lower.
- The credit linked subsidy will be available only for loan amounts upto Rs 6 lakhs and additional loans beyond Rs. 6 lakhs, if any, will be at nonsubsidized rate.
- Interest subsidy will be credited upfront to the loan account of beneficiaries through Primary Lending Institutions (PLI), resulting in reduced effective housing loan and Equated Monthly Installment (EMI).
- The Net Present Value (NPV) of the interest subsidy will be calculated at a discount rate of 9 %.

Home Ownership

The houses constructed/acquired with central assistance under the Mission should be in the name of the female head of the household or in the joint name of the male head of the household and his wife, and only in case when there is no adult female member in the family, the house can be in the name of male member of the household.

Coverage

All Statutory Towns as per Census 2011 and towns notified subsequently, including planning area as notified with respect to Statutory Town.

Purpose

New construction, acquisition and addition of rooms, kitchen, toilet etc. to existing dwelling houses as incremental housing.

Beneficiaries

- Beneficiary family will comprise husband, wife and unmarried children.
- The beneficiary family should not own a pucca house either in his/her name or in the name of any member of his/her family in any part of India.
- EWS Households having annual income up to Rs. 3,00,000/-
- LIG Households having annual income between Rs. 3,00,001/- and upto Rs. 6,00,000/-
- Preference under the scheme, subject to beneficiaries being from EWS/LIG segments, should be given to Manual Scavengers, Women (with overriding preference to widows), persons belonging to Scheduled Castes/ Scheduled Tribes/ Other Backward Classes, Minorities, Persons with disabilities and Transgender.

Area which can be constructed

- Carpet area of house being constructed or enhanced under this component of the Mission should be upto 30 square meters for EWS category and upto 60 square meters for LIG category.
- Beneficiary, at his/her discretion, can build a house of larger area but interest subsidy would be limited to first Rs.6 lakh only.
- For incremental housing/extension, the area limit will be 30 sq.mt. and 60 sq.mt. of carpet area for EWS and LIG category respectively.

Subsidy and Loan details

- Maximum loan amount: as per eligibility of customer decided by bank / Financial Institution based on due diligence.
- Maximum loan tenure : based on the guidelines of the PLI.
- Maximum tenure for subsidy computation: 20* years or the tenure of the loan, whichever is lower.
- Maximum loan amount for subsidy calculation: Rs. 6 lakh.
- Interest rate for subsidy : 6.5%

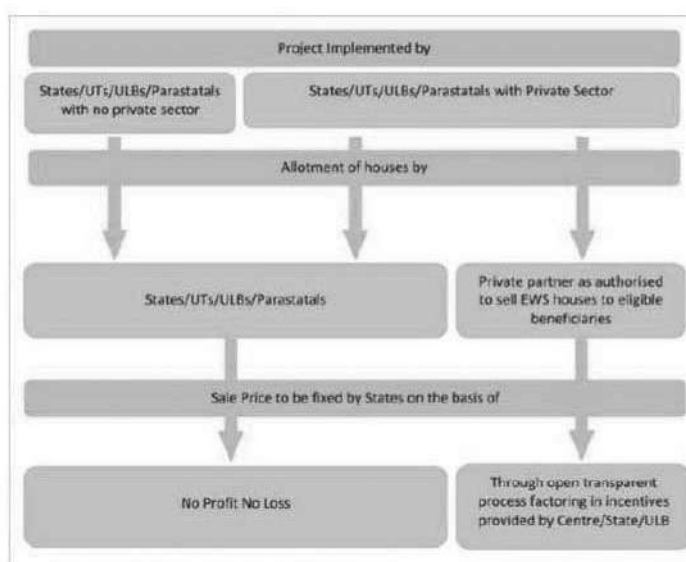
Housing and Urban Development Corporation (HUDCO) and National Housing Bank (NHB) have been identified as Central Nodal Agencies (CNAs) to channelize this subsidy to the Primary Lending Institutions and for monitoring the progress of this component. This scheme will be implemented through Banks/Financial Institutions.

6.12.1.3 Affordable Housing in Partnership (AHP)

The third component of the Mission is Affordable Housing in Partnership which is a supply side intervention. The Mission will provide financial assistance to EWS houses being built with different partnerships by States/UTs/Cities.

Affordable housing projects are the projects where atleast 35% of houses are constructed for EWS category.

- To increase availability of houses for EWS category at an affordable rate, States/UTs, either through its agencies or in partnership with private sector including industries, can plan affordable housing projects.
- Central Assistance at the rate of Rs.1.5 Lakh per EWS house would be available for all EWS houses in such projects.
- The States/UTs would decide on an upper ceiling on the sale price of EWS houses in rupees per square meter of carpet area in such projects with an objective to make them affordable and accessible to the intended beneficiaries. For that purpose, States/UTs and cities may extend other concessions such as their State subsidy, land at affordable cost, stamp duty exemption etc.
- The sale prices may be fixed either on the project basis or city basis using following principles:
- An Affordable Housing Project (AHP) can be a mix of houses for different categories but it will be eligible for central assistance, only if at least 35% of the houses in the project are for EWS category and a single project has at least 250



EWS houses. CSMC at GOI level, however, can reduce the requirement of minimum number of houses in one project on the request of State Government.

- Allotment of houses to identified eligible beneficiaries in AHP projects should be made following a transparent procedure as approved by SLSCM and the beneficiaries selected should be part of HFAPoA.

- Preference in allotment may be given to Physically Handicapped Persons, Senior Citizens, Scheduled Castes, Scheduled Tribes, Other Backward Classes, Minority, Single Women, Transgender and Other Weaker and Vulnerable Sections of the Society.
- While making the allotment, the families with person with disability and senior citizens may be allotted house preferably on the ground floor or lower floors.
- Detailed Project Report (DPR) of such projects prepared by concerned implementing agencies should be approved by SLSMC.

Coverage

- All statutory towns as per Census 2011 and towns notified subsequently would be eligible for coverage under the Mission.
- The Mission will support construction of houses upto 30 square meter carpet area with basic civic infrastructure.
- States/UTs will have flexibility in terms of determining the size of house and other facilities at the State/UT level in consultation with the Ministry but without any enhanced financial assistance from Centre.
- Affordable Housing Projects in partnership should have basic civic infrastructure like water, sanitation, sewerage, road, electricity etc.
- The minimum size of houses constructed under the Mission under each component must conform to the standards provided in National Building Code (NBC).
- The houses under the Mission should be designed and constructed to meet the requirements of structural safety against earthquake, flood, cyclone, landslides etc. conforming to the National Building Code (NBC) and other relevant Bureau of Indian Standards (BIS) codes.
- All houses built or expanded under the Mission should essentially have toilet facility.
- The houses constructed/acquired with central assistance under the Mission should preferably be in the name of the female head of the household or in the joint name of the male head of the household and his wife.
- Only in cases when there is no adult female member in the family, the house can be in the name of male member of the household.

Implementation

A beneficiary will be eligible for availing only a single benefit under any of the existing options i.e. Slum Redevelopment with Private Partner, Credit Linked Subsidy, Direct Subsidy to Individual Beneficiary and Affordable Housing in Partnership. It will be the responsibility of States/UTs Government to ensure that the beneficiary is not given benefit under more than one component of the Mission.

6.12.1.4 Beneficiary Led Construction (BLC)

Beneficiaries could avail the benefits of scheme component for New construction and Enhancement of existing house. Highlights of 'Beneficiary Led (Individual House) Construction' or Enhancement (BLC) Progress to be tracked through geo tagged photographs of the house.

Eligibility for New Construction

- Urban residents of EWS : Economically Weaker Section (annual income upto Rs 3 lakhs) & LIG: Low Income Group (annual income Rs 3 to 6 lakhs).
- Beneficiary families should not own a pucca house anywhere in India.

For BLC Enhancement

- Beneficiaries may be residing either in slums or outside the slums.
- Beneficiaries in slums which are not being redeveloped can be covered under this component if beneficiaries have a Kutcha or Semi-Pucca house.

Benefit

- To individual eligible families belonging to EWS categories, to either construct a new house or enhance existing house on their own to cover the beneficiaries, who are not able to take advantage of other components of the mission.
- Such families may avail of central assistance of Rs. 1.50 lakhs for construction of new house or for enhancement of existing house under the mission.

Why Enhancement

- As per the Technical Group on Urban Housing Shortage (2012-17), 80% of households are living in congested houses.
- Congestion factor is defined as the percentage of households in which each married couple does not have a separate room to live.

Provisions related to enhancement in PMAY(U) Guidelines

As per clause 7.2 (b) of PMAY(U) guidelines:

"If the beneficiary has a pucca house with carpet area of up to 21 sq. mt. or a semi-pucca house, lacking in one of the facilities (i.e. room, kitchen, toilet, bathroom or a combination of any of these), it may be taken up for enhancement subject to ULB/State ensuring structural safety of the house and adherence to following conditions:

- The total carpet area after enhancement must not be less than 21 sq mt and must not be more than 30 sq mt.
- Enhancement shall mean addition of minimum carpet area of 9.0 Sq Mt into the existing house with pucca construction of at least one habitable room or room with kitchen and/or bathroom and/or toilet conforming to NBC norms.
- The details of the enhancement proposals under BLC vertical shall be submitted in proposed Annexure 7D of the PMAY (U) guidelines."

6.13 Strategies for Housing & Inclusive Development

The housing strategies adopted for the Master Plan – 2045 is based on the principles of densifying areas where there is ample infrastructure available and land is available for residential development. Through the development control regulations, the authority intends to promote mid rise development to optimize the utilization of land and infrastructure and increase the housing stock in the planning area at minimum infrastructure cost to the government. The authority has adopted the mixed use land use to promote residential use adjacent to the employment centers and in areas where the employment centers are absent or in areas far from the residential areas, the authority has tried to bring in employment generating landuses in an attempt to strengthen these areas and promote better housing options nearby for the local population.

Providing residence adjacent to the employment center safeguards the interest of Economically weaker sections who prefers to stay closer to work and avoid transportation cost. It is also advised through the Master Plan-2045 to promote affordable housing by earmarking land for residential projects for economically weaker sections of the planning area. Through Master Plan - 2045 the authority has identified the new conurbation for 2045 which forms a continuous development with residential as a major land use to address the major housing requirements of the planning area. This also enables the merger of unplanned development taken place during the last few decades into main urban development of the planning area with proper circulation network and basic infrastructure.

7. Infrastructure, Public Utilities & Services

Infrastructure is the key determinant to the community which decides the functions towards their socio-economic development of the city. Facilitation of sustainable development the physical and social infrastructure are very much essential. Physical and social Infrastructure is the basic requirement which decides the quality of urban and rural life & the overall productivity of the people. This chapter deals with the analysis of existing conditions of physical infrastructure such as Water Supply, Sewerage System, Solid Waste Management, Fire services and Power as well as social infrastructure viz., Health and Educational, Recreational facilities. Based on the analysis and clear understanding of existing scenario, future predicted the physical and social infrastructure for the projected year 2045.

In the formulation of infrastructure plan, attention was given to the followings. Emergency task is to directly respond to the basic needs of physical and social infrastructure both for the present communities and new settlement of the returnees.

Needs survey at the community level is a fundamental study for preparation of urgent rehabilitation and development programs for basic physical and social infrastructure. The plan is to be prepared as practicable and flexible one by staging the needs and level of services of basic infrastructure.

Institutional strengthening and capacity building will be carried out through actual planning and construction of the basic infrastructure, at the community, state government and GOSS levels.

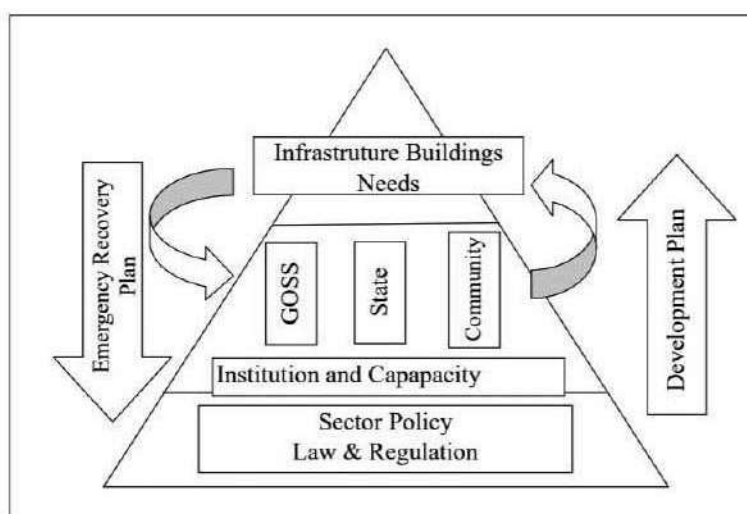


Figure 7-1: Conceptual Constitution for Infrastructure Plan

7.1 Physical Infrastructure

Infrastructure is the basic physical structures needed for the operation of society for an economy to function and physical networks that support society. Socio-economic growth of a town/city and the physical Infrastructure development in the town. Urban physical infrastructure (UPI) is one of the major assets of a city in terms of capital investment, critical services provisioning, and sustainable and resilient urban development. UPI includes physical objects like roads, sewerage, energy networks. Various data regarding details about the amount of water supply, Hours of Supply, number of bore wells, details of sewerage system viz. capacity of STPs and details of drainage, etc. have been procured from Guwahati Municipal Corporation.

Guwahati Master Plan Area (GMPA) has the population of **11,41,699** (Census, 2011) and the population is projected to increase up to **38,63,812** for the horizon year 2045. Therefore, to meet the future demand, calculation of the same for various sectors is necessary and the same is dealt with in this chapter.

7.1.1 Water Supply

In the present section, the existing situation of water supply in the study area shall be examined in the light of all the available secondary information. At present, the water supply facilities in Guwahati Metropolitan Area (GMA) are operated by Four departments, viz., Guwahati Municipal Corporation (GMC), Zoo Road Water Supply Scheme (ZRWSS), Assam Urban Water Supply and Sewerage Board (AUWSSB) and Public Health Engineering Department (PHED). The existing systems cater to about 30% of the residents. Besides the water supply system, households mainly use groundwater and water supplied through tankers.

7.1.1.1 Source of Raw Water

There are two main sources of water supply in Guwahati viz., Surface water and Ground water. The major source of surface raw water in the city is the river Brahmaputra and its tributary Bahini.

The average discharge of Brahmaputra is $4500\text{m}^3/\text{s}$. The water level of Brahmaputra varies by around 10 m between winter and monsoon periods. The river flows nearly full for a considerable length of time and for 50% of the days out of 150 monsoon days, the level remains above 48.17 m above MSL. The discharge of river Bahini, coming down from K&J hills, is very nominal during winter, but moderately high during

summer. At present only river Brahmaputra appears to be the major source of water supply in the city.

Yield from shallow tube wells is not significant within the Guwahati Metropolitan Area. Possibilities of extracting ground water in considerable quantity is remote in the hard rock areas as observed in the report on "Guwahati Water Supply and Sewerage Project" prepared by the Town Planning Organization.

7.1.1.2 Surface Water Supply Scenario in Guwahati

7.1.1.2.1 Exiting Water Supply Scenario:

At present the estimated population within GMPA for the year 2021 is 1475651, considering 135 LPCD water consumption city's current water demand is approx. 232.90 MLD including all external factors where only 76.65 MLD of surface water is supplied. This means water demand which is approx. 33% of the daily water demand is being addressed by surface water by four concerned departments which are GMC (Guwahati Municipal Corporation) and ZRWSS (Zoo Road Water Supply Scheme), PHED (Public Health Engineering Department), and AUWSSB (Assam Urban Water Supply and Sewerage Board). Rest of the 67% of the water demand is fulfilled by groundwater supply. The following Table 7-1 reveals the details of piped water supply in the entire Guwahati. Although GMC and ZRWSS supply water within GMC wards, PHED and AUWSSB caters the other areas of Guwahati Metropolitan Area.

Table 7-1: Surface Water Supply Details in GMPA

Parameters	GMC	ZRWSS	Total	Remarks
Water treatment Plant Capacity	74 MLD Panbazar (45 MLD), Silpukhuri (22.5 MLD), Kamakhya (4.5 MLD), Deep Tubwell (2 MLD)	12.6 MLD	86.6 MLD	PHED T.P. Panbazar (11.25 MLD), PHED T.P. Jalukbari (4.5 MLD), AUWS & SB T.P. (11.25 MLD)
Treated Water Supply	45 MLD Panbazar (25 MLD), Silpukhuri (15 MLD), Kamakhya (3.5), Deep Tubwell (1.5 MLD),	9.6 MLD	54.6 MLD	PHED T.P. Panbazar (11.25 MLD), PHED T.P. Jalukbari (4.5 MLD), AUWS & SB T.P. (11.25 MLD)
Daily Water Supply	40.6 MLD	7.05 MLD	47.65 MLD	27 MLD (PHED & AUWSSB) + 2 MLD (JNNURM Project)
No. of connections	30,500 No's	6500 Nos	37000 No's	
Length of Distribution Network	420 K.M.	150 K.M.	570 K.M.	

Daily Supply Duration	-----	2 hrs. daily in 3 times	
No. of Metered Connection	3547 Nos	6500 Nos	10047 Nos
Water Storage Capacity	24.1 ML	2.35 ML	
total Public Taps	147 Nos.	-----	147 Nos.
Water Tankers	13	-----	
Water Distribution Coverage	Hati gaon, bhangagarh, Ujanbazar, Khanguli, fatasil, Ambari, Silpukhuri, Chanmari	Zoo Road , Hengrabari, Sorumotoria, Rukminigaon, Runagar	---

(Source: Compiled by Consultants)

From the above table it can be observed that within GMC total water treatment capacity of different water treatment plant is 86.6 MLD out which only 54.6 MLD of water getting treated and supplied and where 47.65 MLD is finally getting supplied by GMC and ZRWSS, it can be assume that there is some percentage of water loss during supply after treatment. However, there are three other water treatment plant at Pan bazar and Jalukbari under PHED and AUWSSB, where 27 MLD of water is being treated and supplied daily and under JNNURM presently 2 MLD of water is being supplied.

Guwahati Municipal Corporation has three water supply treatment plants at Panbazar, Silpukhuri and Kamakhya. Water is pumped from river Brahmaputra to these treatment plants and after processing in the plant water is pumped to different reservoirs located at hilltops and from these reservoirs distributed to the consumers by gravity main. Some areas are supplied through direct pumping also. Beside these plants there are 8 (eight) functional deep tube wells at different locations. Installed capacity and present running capacity of each plant are as indicated below.

Table 7-2: Details of Water Treatment Schemes in GMPA

Name Of Scheme	Location	Horizon Year	Source of water	Intake	Treatment Process	Present production	Installed capacity	Zone/area served
GMCT.P (1960)	Panbazar	1980	Brahmaputra Panbazar	Barge	Conventional	34.00	45.00 (10 Mgd)	Panbazar, Fancy bazaar, Kumarpara, Atgaon, Paltan bazaar, Ulubari Sarania, Lachitnagar
GMCT.P. (1985)	Silpukhuri	2000	Brahmaputra	Barge Kharguli	Conventional	18.00	22.50 (5 mgd)	
(i)Kamakhya (old) GMCT.P (1956)	Kamakhya Hill (foot hill)	1986	Brahmaputra	Direct pumping	Sedimentation only	0.25	1.35 (0.3 Mgd)	Kamakhya Hill
(ii) New Kamakhya GMCT.P (1992)	Kamakhya Hill	2007	Brahmapura	Barge near Kalipur Asram	Conventional	Not in operation	4.50 (1 Mgd)	Kamakhya Hill Town
Total (GMCT.P.)						52.25	73.35	
PHED T.P (1976)	Panbazar	2006	Brahmaputra Panbazar	Barge	Conventional	11.25	11.25 (2.5 Mgd)	Medical College, Dispur, AAU, Henigrabari etc.
PHED T.P (Jalukbari) (1979-71)	University Jalukbari	2001	Brahmapura	Barge near Pandu	Conventional	4.50	4.50 (1 Mgd)	Guwahati University, Engg. College, Ayurvedic College
Total (PHED T. P.)						15.75	15.75	
AUWS & SB T.P (1995)	Hengrabari	2010	Brahmaputra	Barge Kharguli	Conventional	11.25	11.25 (2.5 Mgd)	Zoo Road, Henigrabari Japriogetc.

(Source: Nath, Bhattacharjee & Bezbaruah, "Water Supply in Greater Guwahati")

The Following Table 7-3 represents the detailed data on existing water supply infrastructure, Revenue data and support staff numbers etc.

Table 7-3: Present Water Supply Infrastructure, Appliances and Support Staff

No. of connection	30,500 (approx)	
Area covered (from Panbazar Plant)	Panbazar, Fancy Bazar, Machkhowa, Bharalumukh (Part), Athgaon, Chatribari, Serabbhati, Rehabari, Paltanbazar, Ulubari, Lachit Nagar, Pub-Sarania, Dakhin Sarania, Gandhibasti, Kacharibasti, Solapara area etc.	
(from Silpukhuri Plant)	Uzanbazar, Chenikuthi, Guwahati Club, Silpukhuri, Chandmari, Govt. Press are, Kharghuli, Housing Colony, Krishnanagar, Nizarapar, Kanwachal, Nabagiri, Pensionpara, Milanpur, Nabagraha area, Udaigiri, Chitrachal Hill area etc.	
(from Kamakhya Plant)	Kamakhya Township, Foot Hill area of Kamakhya, Kalipur, Kamakhya Colony, Pandu, A.T. Road, Maligaon North side etc.	
(from Deep Tube Well Schemes)	T. R. Phookan Park DTWS	B.R.Phukan Road, F.A. Road, Kumarpara, G. S. Colony, Bharalu East (Part)
	Fatasil Horizon Colony DTWS	Horizon Colonies, Fatasil Ambari, Bishnupur (Part)
	Rangpathar DTWS	Rangpathar areas, Fatasil Ambari areas.
	Santipur DTWS	Santipur Hill Area, Durgasarobar areas
	Kalapahar DTWS	Kalapahar (Part), Lalganesh (Part), Cycle Factory area (Part),
	New Field (Boosting) DTWS	Rehabari (Part), Bilpar area
	Lalganesh DTWS	Barsapara, Udalbakra (Part), Lalganesh
	Basisthapur DTWS	Basisthapur areas (maintained by local committee)
No. of Reservoir	22 nos.	
Average daily water supply	Through piped network =	400.00 Lakhs Liter
	Through mobile tanker =	6.00 Lakhs Liter
	Total =	406.00 Lakhs Liter
Length of distribution network	420.00 K.M.	
No. of employees working	Regular employee =	126 nos.
	Daily Wage employee =	76 nos.
	Total =	202 nos.
No. of vehicle for mobile water supply	13 No's	6 (Running) 7 (Under Repairing)
O.M. Expenditure (Annually)	Electricity Bill	Rs.600.00 Lakhs (approx.)
	Chemicals (Alum & Bleaching powder)	Rs.46.00 Lakhs (approx.)
	Repairing of machineries & pipelines	Rs. 35.00 Lakhs (approx.)
	Salary of employees	Rs. 550.00 Lakhs (approx.)
	Total =	Rs. 1,231.00 Lakhs (approx.)
Revenue collection	From different source of Water Works	Rs. 275.00 Lakhs (approx.)
	From Water Tax collected with property tax	Rs. 345.00 Lakhs (approx.)
	Total =	Rs. 620.00 Lakhs (approx.)

No. of Metered connection (@140.00/month)	Panbazar- 1106 nos. Satpukhuri- 793 nos. Kamakhya- 1149 nos. Deep Tube Well- 244 nos.	Total= 3292 nos.
No. of temporary connection (@ 200.00/month)	Panbazar- 02 nos. Silpukhuri- 175 nos. Kamakhya- 72 nos. Deep Tube Well- 06 nos.	Total= 255 nos.

(Source: Office of Executive Engineer, GMD, Assam, 2020)

The following Table 7-4 provides the details of water supply by Zoo Road Water Supply Scheme within GMPA.

Table 7-4: Water Demand assessment for Water Supply Source & Rehabilitation System

ZOO ROAD WATER SUPPLY SCHEME GUWAHATI METROPOLITAN DRINKING WATER & SEWERAGE BOARD	
Total demand of water in city south Guwahati	396 MLD
Total supply of water in city south Guwahati	7.05 MLD (Zoo Road Water supply scheme)
Water treated before supply (Zoo Road Water supply scheme)	10.9 MLD
% Of household getting water supply from Zoo Road Water supply scheme	6.69%
Duration of water supply in domestic area	3 different zones in 3 different times
Zoo Road Water supply scheme	Source from Brahmaputra
Storage capacity	2.35 ML (2 two over-ground reservoir)

(Source: Guwahati Metropolitan Drinking Water & Sewerage Board)

The Following Table 7-5 summarizes the present water supply details with estimated water demand within GMPA and indicates the lacuna in the current water supply provisions.

Table 7-5: Assessment of present water demand, Supply and Gap in the current scenario

Area	Population	Water Demand (MLD)*	Water Supply (MLD)	Water Supply (%)	Gap (MLD)
GMC	2011 (census)	962334	47.65	32%	101.75
	2021 (Estimated)	1222013		25%	142.05
GMDA (Excluding GMC)	2011 (census)	179365	27.00**	97%	0.80
	2021 (Estimated)	227765		76%	8.40

*Note: Water Demand estimated considering water loss of 18%

** Assuming PHED & AUWSSB able to supply 100% water of installed treatment plant capacity.

(Source: Compiled by Consultants)

7.1.1.2.2. Forecasted Water Supply Scheme:

Apart from all these water supply schemes, few new water supply project enrolled by government of Assam and undertaken by JNNURM, JICA and AUIP. For the year 2025, under JNNURM 107 MLD capacity potable water supply infrastructure project (installation of 2 WTP of capacity 53.05 MLD each) aims to provide 24x7 potable water which will cater water demand of approx. 4.45 Lakhs population of South Guwahati Western region which is falling within a command area of 100.95 km under Guwahati Metropolitan area within 54 nos. district metering area. However, 30% of the JNNURM project is under progress and about 4.75 Km pipeline is being laid down. According to officials presently they are able to supply 2 MLD and rest of the committed quantity of water will be supplied once the infrastructure installation works will be done. The water supply project under JICA is divided into two different categories South Central and North Guwahati which is further divided into 7 different water supply zones. For the year 2025 JICA aimed to supply total 228 MLD of water withing designated zones to address 13 lakhs people's water demand. Following table provides the details about the future water supply schemes within GMPA under various mission, it is expected that the project will be fully implemented within its due period. And after this all the water supply projects will be completely undertaken by Jal board who will be responsible for supply and management of water related concerns.

Table 7-6: Upcoming Water Supply Scheme in GMPA

Water Supply Schemes	Capacity of WTP (MLD)		Length of Distribution (K.M.)
	Year 2025	Year 2040	
JNNURM	107	170	452
JICA			
South Central	191	255	1050
North Guwahati	37	57	111
AUIP	98	155	540
Total	433	637	2153

(Source: Guwahati Metropolitan Drinking Water & Sewerage Board)

The Following figure 7.2 illustrates the exiting piped water supply scenario. It also shows the present water supply infrastructures locations within GMPA which includes water intake points from the Brahmaputra, water reservoirs, water pumping stations, treatment plants, pipelines etc. JICA water supply zones are also illustrated with coloured polygons.

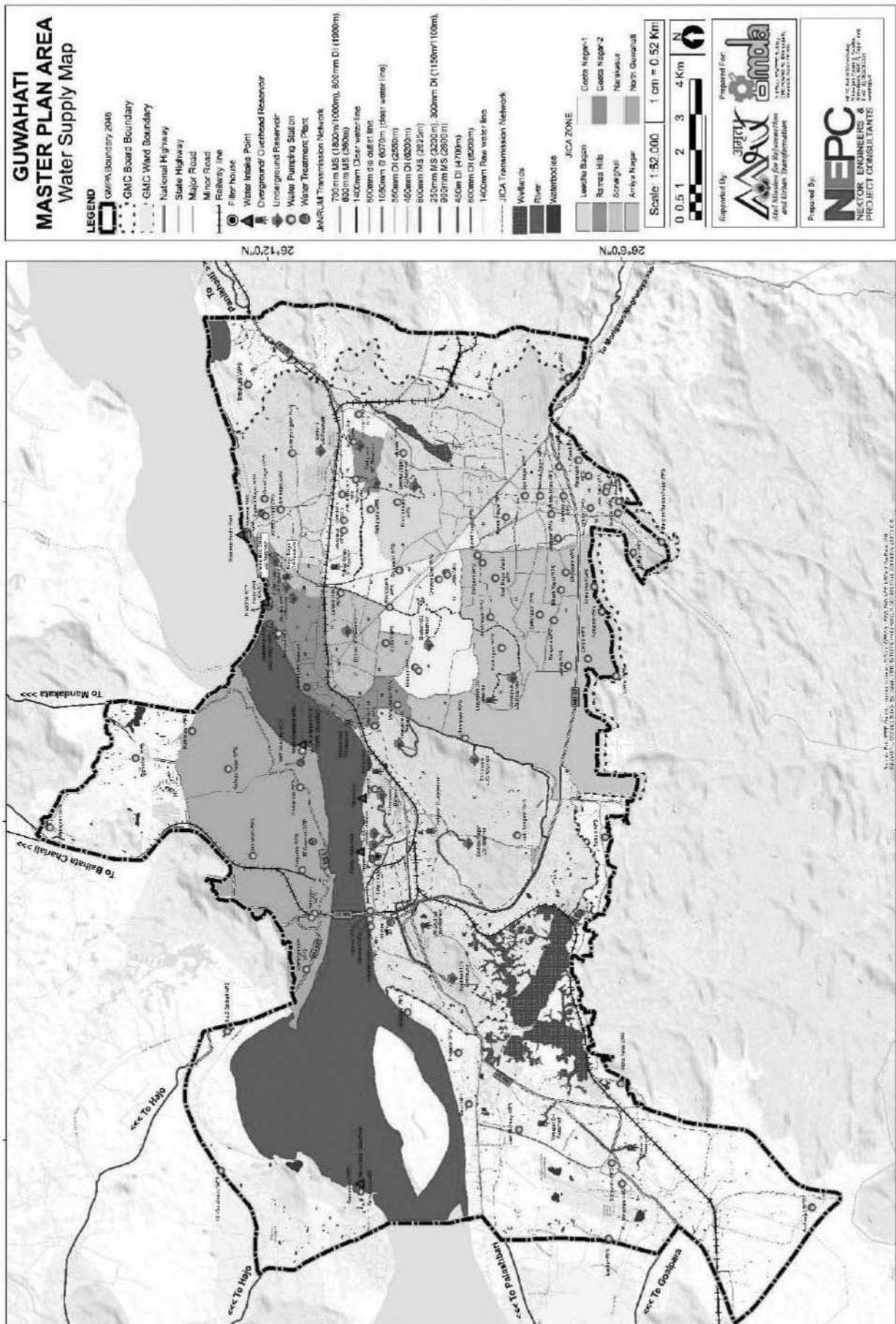


Figure 7-2 Water Supply Infrastructure Map of GMPC

7.1.1.3 Ground Water Scenario:

7.1.1.3.1 Hydrogeology

The area consists of two broad hydrogeological units – 1) Pre-Cambrian consolidated rocks and 2) Quaternary alluvium consisting of unconsolidated sediments (Plate-2). Pre-Cambrian consolidated rocks are confined to hilly areas and inselbergs, where ground water occurs in shallow weathered zone, and this can be developed through open wells. The joints and fractures developed due to tectonic activities form potential water bearing zones and suitable for development through construction of bore wells. In the alluvial plain, groundwater occurs in regionally extensive aquifers down to the depth of 305 m. It has a very good yield prospect. The aquifers are consisting

of sands of various grades with gravel and are suitable for construction of both shallow and deep tube wells. Groundwater occurs under unconfined to semiconfined condition occupying an area of about 200 sq. km. in and around Baihata –Dumuni chowki which is under artesian condition. In other parts also, the water level rests at shallow depth and in major part, it rests between 2 – 5 metres below ground level (mbgl) during pre-monsoon period. The study of long-term water level trend shows no significant change in rise/fall in water level in the last 10 years. The shallow tube wells tapping aquifers within 50 m depth are capable of yielding about 10 liters per second (lps) in major places, deep tube wells constructed within 95 m depth tapping about 30 m granular zones are yielding 10 – 20 (liters per minute) lpm. The transmissivity of the aquifer ranges from 41 to 6162 m²/day and the permeability varies from 10 to 59 m/day. In hard rock, the yield of bore well constructed in greater Guwahati area ranges from 4 to 300 lpm. The dispositions of aquifers in Kamrup district, Assam are shown in (Plate-IIIa-IIIc).

7.1.1.3.2 Ground Water Resources:

Dynamic ground water resources of Kamrup district are estimated based on the methodology adopted as per GEC 1997, following water level fluctuation and rainfall infiltration factor methodology.

The annual dynamic ground water resources as on 2009 are estimated to be 1847.29 MCM while the net annual ground water draft is 715.97 million cubic meters (MCM). The stage of ground water development is 43%. The projected demand for domestic and industrial uses up to 2025 is estimated to be about 105.16 MCM. The district is

still under 'Safe' category and sufficient resources are still available for future development.

7.1.1.3.3 Ground water Quality:

The water samples collected from the monitoring stations and the exploratory wells drilled in different parts of the district were analysed in the Chemical Laboratory of C.G.W.B., NER, Guwahati. The results of the chemical analysis of ground water samples reveal that ground water is fresh, potable, and suitable for both domestic and irrigation purposes. However, due to slightly higher content of iron in some sporadic patches of the area and fluoride content exceeding permissible limit in some pockets in and around Guwahati City, water needs to be treated before being used for drinking purpose.

Table 7-7: Chemical Composition of Ground Water in GMPA

Zone	Chemical Contents of Ground Water							
	Chloride	pH	Hardness	Calcium	Turbidity	Iron	Alkalinity	Acidity
South Central	12.66	6.42	50.00	12.82	3.90	1.61	102.67	99.33
South-East	57.65	6.45	131.33	27.78	9.60	1.02	36.67	93.33
South-West	360.97	6.35	336.67	109.01	2.67	0.25	212.67	136.00
North Guwahati	363.21	6.53	288.00	68.40	5.33	0.58	162.00	128.00

(Source: Farheena Islam, (2014) "Quality Analysis of Ground Water In Greater Guwahati", Journal of Civil Engineering and Environmental Technology)

7.1.1.3.4 Ground Water Pump Stations:

Table 7-8: Pumping Facility with Ground Water as Source Installed in Guwahati by GMC and PHED

No	Location of pump	Intake	Numbers	Discharge Capacity	Total Discharge
1	Bharalumukh	Direct Pumping	10	400HP×4 nos.×1667 ltr/sec 250HP×2 nos.×1000 ltr/sec 150HP×2 nos.×0800 ltr/sec 368HP×2 nos.×1700 ltr/sec	13668 ltr/sec
2	Mora-Bharalu	Direct Pumping	4	167HP×4 nos.×1000 ltr/sec	4000 ltr/sec
3	Lakhimijan	Direct Pumping	2	368HP×4 nos.×1700 ltr/sec	3400 ltr/sec
4	Bondajan	Direct Pumping	2	368HP×4 nos.×1700 ltr/sec	3400 ltr/sec
5	Pandu	Direct Pumping	2	167HP×4 nos.×1000 ltr/sec	2000 ltr/sec
6	Sadilapur	Direct Pumping	2	167HP×4 nos.×1000 ltr/sec	2000 ltr/sec
7	Anil Nagar	Direct Pumping	4	4 nos.×350 ltr/sec	1400 ltr/sec

8	Lachit Nagar	Direct Pumping	2	2 nos.×350 ltr/sec	7000 ltr/sec
9	Lachit Lane (Rajgarh Bridge)	Direct Pumping	1	1 nos.×150 ltr/sec	150 ltr/sec
10	Tarun Nagar	Direct Pumping	6	2 nos.×350 ltr/sec 4 nos.×042 ltr/sec	868 ltr/sec
11	Jonali	Direct Pumping	1	1×350 ltr/sec	350 ltr/sec

(Source: Office of Executive Engineer, GMD, Assam, 2020)

Table 7-8 provides the details of groundwater pumping station locations installed by GMC and PHED to supply water. The discharge capacity and the total quantity of discharge is also mentioned for all the pump locations.

Table 7-9: Ground Water Supply Connections under various distribution centres in Guwahati

Location of Deep Tube Well	Total Connections Nos.
TR Phukn DTWS	400
Harizon Colony DTWS	183
Rangpathar DTWS	350
Santipur DTWS	400
Kalapahar DTWS	300
New Field DTWS	500
Lalganesh DTWS	50
Lalganesh Banikpara	122
Basisthapur DTWS	147
Total	30,002

(Source: Compiled by Consultant)

The above Table 7-9 provides the data of number connections through which water is being supplied from Deep tube well

The following figures illustrate the yearly from 2015 to 2019 ground water levels at 31 different locations within GMDA during four different seasons (January, March, August, and November). Higher the mbgl (meter below ground level) value depicts water level below ground. It is observed that the locations near Brahmaputra River having low mbgl values as the ground water level is higher compared to the locations situated far away from the river

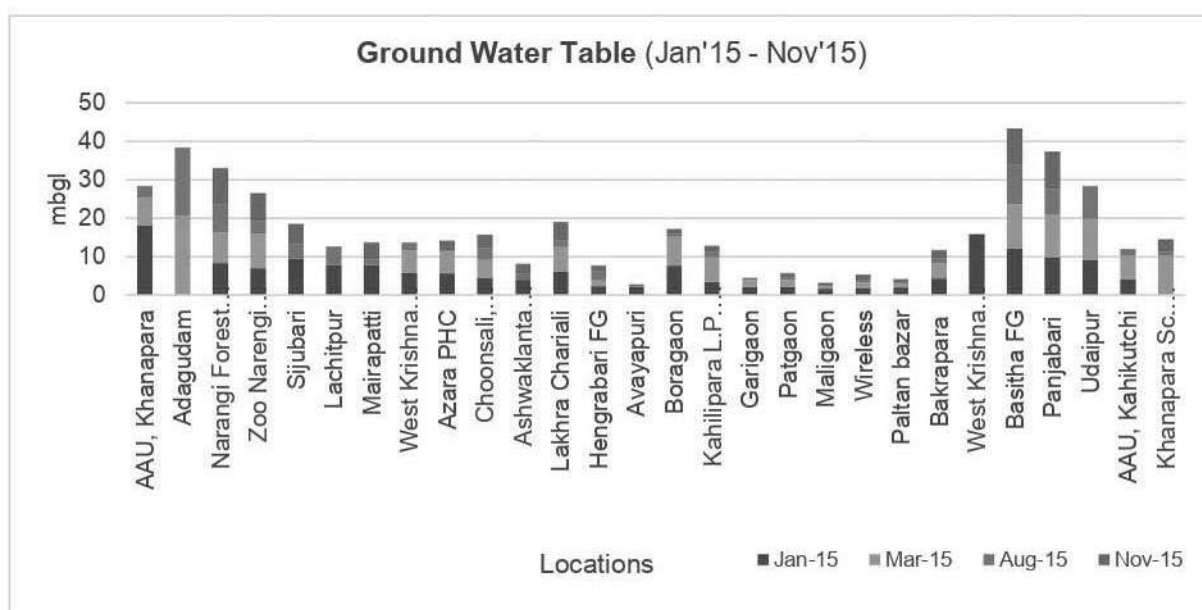


Figure 7-3: Ground Water Table (Jan'15 to Nov'15)

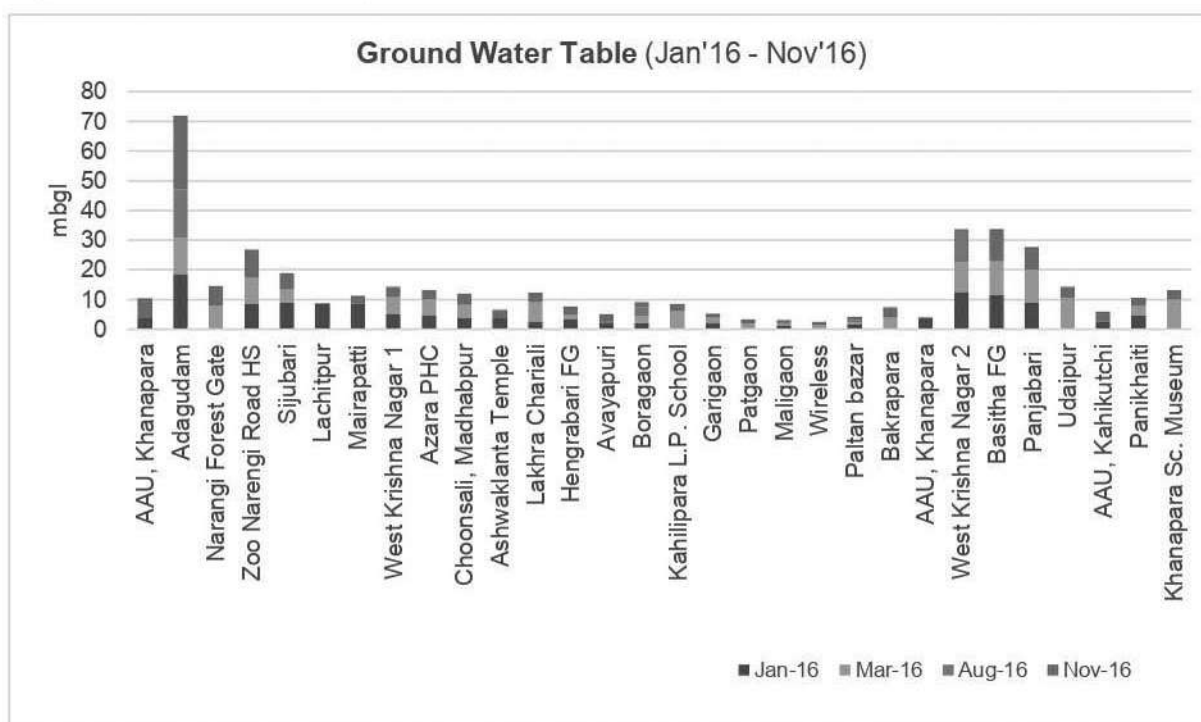


Figure 7-4: Ground Water Table (Jan'16 to Nov'16)

Figure 7-4 and 7-5 illustrate the ground water table during the year 2016 and 2017. Where it can be observed the significant change in ground water level. Places like Narengi, Sijubari, Avayapuri, Boragaon having low mbgl Value during the year 2016 while in 2017 the values increased at higher rate.

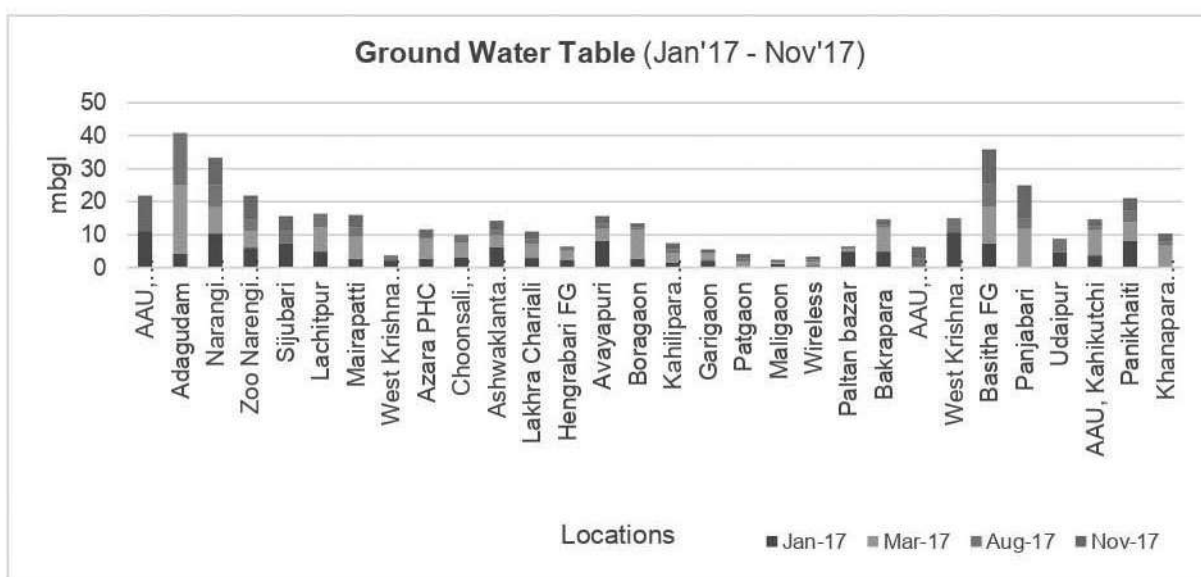


Figure 7-7: Ground Water Table (Jan'17 to Nov'17)

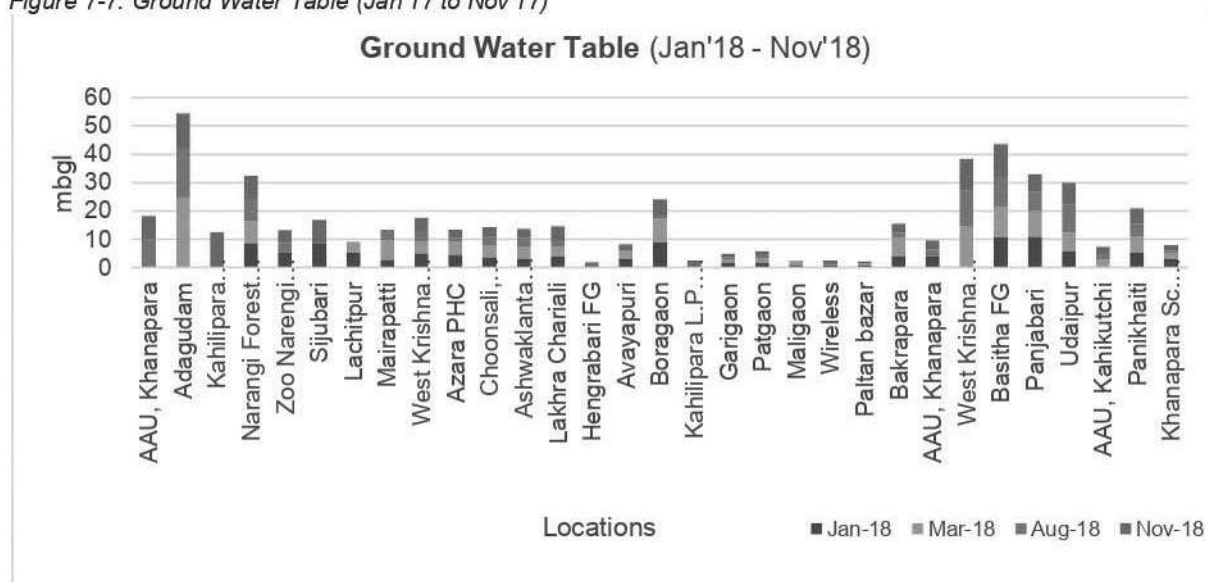


Figure 7-6: Ground Water Table (Jan'18 – Nov'18)

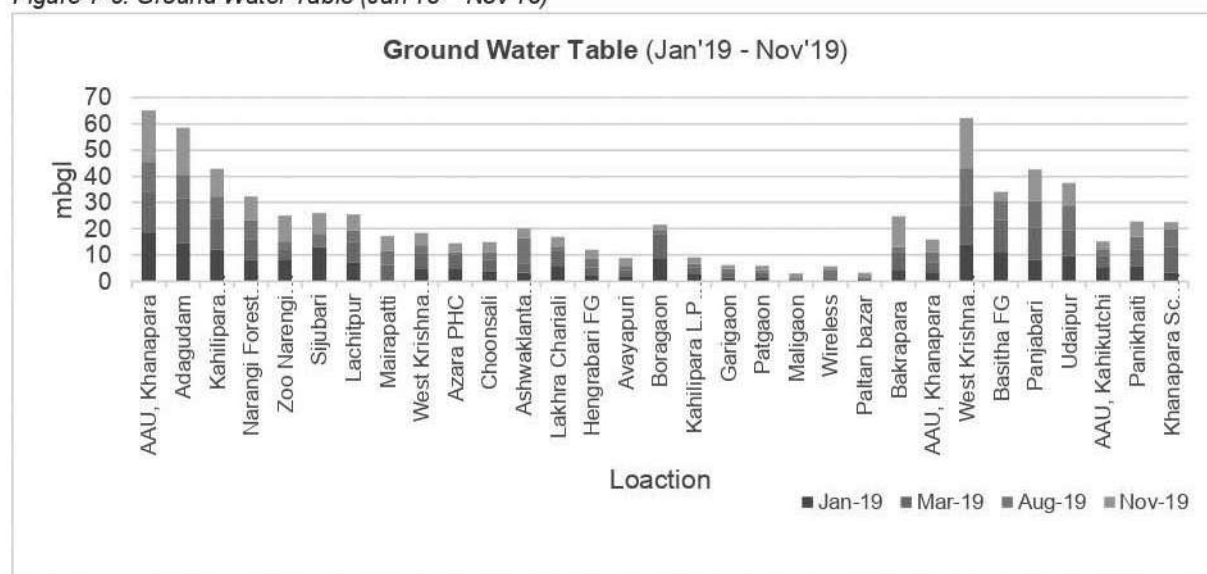


Figure 7-5: Ground Water Table (Jan'19 – Nov'19)

Table 7-10: Future Water Demand Forecast

Sl. No	Particular	2011			2021			2031			2045		
		Population	Amnt. of Water supply (LPCD)	Total demand in MLD	Population	Amnt of Water supply (LPCD)	Total demand in MLD	Population	Amount of Water supply (LPCD)	Total demand in MLD	Population	Amnt. of Water supply (LPCD)	Total demand in MLD
1	Demand for existing population	1141699	135	154.12	1475651	135	199.22	2024566	135	273.32	3863812	135	521.61
2	Fire Demand $100 \times [(population)^{1/1000}]^{1/2/1000}$			3.3			3.84			4.49			6.21
3	Unaccounted Water (15%)			23.11			29.88			40.99			78.24
4	Total Demand			180.53			232.90			318.81			606.06

(Source: Compiled by Consultant)

7.1.1.4 Summary of Water Demand

Table 7-11: Summary of Water Demand for 2045

Sr. No.	Particulars	Demand for 2045
1	Total Projected Population for MPA	3863812
2	Water Demand @ 135 lpcd for planning area in 2045	521.61
3	Fire Demand and Unaccounted Water	(6.21 + 78.24) = 84.45
4	Total water Demand	606.06 MLD
5	Total water demand including Water loss @ 15% of water demand	90.91 MLD
6	Required Water Supply	696.97
7	Existing Quantity of Water Supply	74.65 + 2 MLD (under JNNURM)
8	Extended Future water requirements	620.32

(Source: Compile by Consultant)

The water Demand of entire planning area for 2045 will be around 696.97 MLD, including fire demand and 15% of water losses (Source: CPHEEO manual for water supply) during water supply. In total GMPA is being served with 76.65 MLD through various water supply scheme. And considering future population more 620.32 MLD is required in horizon year. However, Guwahati Jalboard already identified the future water demand and they have stated their aim to provide 637 MLD under various schemes. And this forecasted water demand is adequate to address the future population and it is expected that the aim will be achieved by horizon year.

Status of Water Supply as Per MOUD Service Level Benchmark:

Table 7-12: Water Supply SLB Indicators

Indicators	Guwahati Master Plan Area
Coverage of Water Supply Connection	
Household Connection	37000 no's HH water connection
Length of Distribution	570 K.M. (16%)
Amount of Water Supply	47.65 (20%)
Per Capita Supply of Water	52 LPCD (38%)
Extent of Metering of Water Connections	3547 Nos. (10%)
Extent of Non- Revenue Water	33453 (90%)
Continuity of Water Supply	2 hrs. daily in 3 times
Cost Recovery in water supply services	50%

(Source: Compiled by Consultant)

7.1.1.4 Proposed Strategies

There is an additional requirement of 697 MLD (existing supply 76.6 MLD) water to meet the drinking water demand of Guwahati Planning Area by horizon year 2045. Majority of the drinking water demand can be met using the surface/sub-surface flow of River Brahmaputra as a source of supply through collector wells/intake wells.

Action Plan

- Covering the entire planning area with a continuous water supply system assuring 24 hr supply with adequate pressure in the distribution system even at the tail ends
- Controlled use and management of ground water assuring treatment with disinfectants before distribution
- Public awareness against misuse of water
- Adequate reforms so as to balance the O&M cost with the revenue out of the water supply distribution

For areas outside conurbation, respective Commune Panchayats will have to arrange for the water supply without hampering the environment.

Rainwater Harvesting

Rain water harvesting must be made mandatory in newly developed houses to increase ground water potentials.

Desilting of Tanks

The water tanks located outside conurbation area are recommended to undergo desilting process. This will increase the capacity of the tanks and ultimately lead to better ground water recharge.

Ground Water Recharging

As agricultural land is being converted to urban use, identifying sites for additional groundwater recharge is essential to keep water supplies balanced. The existing village tanks which are normally silted and damaged can be modified to serve as recharge structure. The village tanks can be converted into recharge structure. Several such tanks are available which can be modified for enhancing ground water. Construction of Percolation well is also an option for ground water recharge.

Recycling of Grey Water

Recycling of Grey Water is proposed for Car wash, landscaping, industrial cooling, flushing etc. Recycling of Grey Water should be promoted.

7.1.2 Sewerage

7.1.2.1 Existing Scenario

The GMDA area does not have any integrated sewerage system as such except for certain pockets in the railway colony and the IOC Refinery establishments. Most of these individual houses have septic tanks without any collective disposal of effluents. Moreover, there is no provision for the treatment of the sewage, which are therefore simply released untreated into the nearby drains and low-lying areas. Not only the domestic sewage, the industrial wastes also are similarly disposed. This results in environmental and aesthetic degradation of the city area. There are soak pits connected to individual septic tanks, they do not function well due to high sub-soil water. Table 7-13 shows the existing sanitary facilities in GMDA area, and the population served by those.

Table 7-13: Population Served by Sanitary facilities in Guwahati

Sl. No.	Sanitary facilities	Proportion (%)
a.	Septic Tanks	81.61
b.	Public Conveniences	0.12
c.	Low-cost sanitation units	0.00
d.	Others/ Open Defecation	18.27
Total		100.00

(Source: GMDA)

Table 7-14: Details of Existing Sanitation Facility within GMDA

Sr. No.	Sanitation Facilities	GMC	GMDA (Excluding GMC)	Total
1	Population (2011 Census)	962334	183206	1141699
2	No. of HH	230769	40456	271225
3	Septic Tank (HH coverage)	207692	39647	247339
4	Public Toilets	11	22	33

(Source: Compiled by Consultant)

Figure 7-8 shows the location of public toilet facilities available within the city, here in this figure public toilets are marked with two different colours where red symbols are dedicated public toilets constructed under swatch Bharat Mission and NGOs these are majorly pay and use toilets, while the Blue Colored toilet symbols shows the toilet facilities available at various public spaces like petrol pump, parks, shopping malls etc. these are not paid toilet facilities but serves people.



Figure 7-8: Public Toilet Locations Within Guwahati Urban Area

As at present, majority houses in the city have septic tanks, of which many are not maintained well; hence, overflowing, and dysfunctional. In fact, many septic tanks are now non-functional because of the high-water table, and as a result, much of the untreated wastewater directly flows into the storm water drains or into the natural drainage channels. It is a high time that the authority plan and implement proper public wastewater collection and disposal system to ensure that sewage or excreta and sludge discharged from communities is properly collected, transported, treated to the required degree, and finally disposed of without causing any health or environmental problems. There should be underground sewerage connection to each household and from where the discharged wastewater should go to sewerage treatment plant before discharging it into the natural drains. While planning for the proposed sewerage system, consideration should be given to the natural drainage pattern. The sewerage system should be planned in such a way that there will be minimum pumping involved in collection and conveyance of sewage. New Sewerage Treatment Plant (STP) sites should be identified depending on considerations such as the quantum of environmentally suitable land, and availability of government land, capital, and O&M cost of different options. While the underground sewerage has been planned and implement, the authority needs to make sure that each household in the region has a septic tank installed and is being managed and is fully functioned. Water from

commercial and industrial activities wastewater is being treated before discharging in the river.

The absence of a sewage treatment plant (STP) in the entire state of Assam results in direct discharge of untreated sewage waste into the open surface waters of Guwahati. Hence, the need for sewage water treatment is high, but due to the complexity of the water system and lack of data in Guwahati, there is a limited overview of how to act to improve the water quality in the most efficient way.

During dry season the water system is mainly fed by raw sewage water from the city which is reflected in high pollutant concentrations, in contrast to lower pollutant concentrations during monsoon season when pollution is diluted with a large volume of storm water runoff. Especially during dry winter season, the water quality is poorest, but in this period all scenarios showed to be most effective in improving the water quality. Furthermore, the addition of extra treatment capacity to treat most incoming flow during monsoon season had little effect, neither was a correlation found between total combined treatment capacity of all STPs and reduction in pollutant load from the complete study area.

The Government of India has approved the Japan International Cooperation Agency (JICA) assisted Rs 1,178.75 Crores Guwahati Sewerage Project. The proposed project's objective is to provide reliable sewerage services by carrying out the construction of sewerage facilities and an extensive network of sewers in South and East Guwahati, thereby considerably improving sanitation and living conditions of people in Guwahati City.

The progress attained in the execution of the JICA-funded south-central part of the project is such that a 191 million-litre-per-day capacity water treatment plant is being installed at Kharguli Hillside.

Table 7-15: Proposed Sewage Treatment and Process Project Under JICA

Proposed sewage project	
Location of the Project	(Zone-I) Guwahati Kamrup Metropolitan District (South Central and Southeast Area) Assam
Target Population	(i) 2020: 10.10 lakhs (ii) 2035: 14.95 lakhs (iii) 2050: 23.32 lakhs
Project Implementation Period	7 (seven) Years
Construction of Capacity Treatment Plant on ASP technology	187 MLD
Trunk Sewers	201 Km
Lateral Sewers	501 Km
Laying of Pumping Main Station	16.915 Km
Gravity Main	184.198 Km
Number of Pumping Stations	5 (five) Nos
Number of Lifting Stations	18 (eighteen) Nos.
Number of House Connections, Power Connections and Road Restoration	101058 Nos.
Trenchless Pipe Laying	880 metres
Total Project Cost	JICA Portion: INR 1001.28 crore State Share: INR 177.47 crore Total: INR 1178.75 crore

(Source: Boks, H.J. (2018) Application of SWMM to analyze the effect of sewage water treatment on water quality in Guwahati, India)

Present water supply is approx. 76.65 MLD which is supplied through pipe and the Brahmaputra River is the only source it is estimated that only 30% of the city's water demand is fulfilled by surface water whereas rest of the population are dependent on ground water service. Current water demand is approx. 225 MLD, (estimating 135 LPCD and 15% water loss). Estimating water discharge as 80% of the water consumption finally stands at a position where city generates approx. 181 MLD carried out by natural and manmade drainage channels and finally getting discharged into Brahmaputra River without any treatment. There few key issues in the present sewerage system mentioned below:

7.1.2.2 Issues

- **Absence of sewerage system:** there is absolute absence of sewerage system in Guwahati planning area resulting in discharge of un-treated waste water in drains and river Bramhaputra
- **Mixing of storm water and sewage:** In absence of sewerage and improper drainage system, in many parts of planning area, there is discharge of sewage into storm water drains and other water bodies
- **Maintenance of Septic Tank:** As per the present practice, the septic tanks are the only mode of disposal of sewage in Guwahati planning area, which are not frequently cleaned by the Guwahati Municipal Corporation.
- **Degradation of natural water bodies:** The disposal of waste water into drain and in other water bodies resulting degradation and contamination of water and land.



Figure 7-9: Sewage Drains Carrying Mass Solid waste creating water logging



Figure 7-10: Degradation of Urban rivers due to disposal untreated wastewater

The following Table 7-16 shows the forecasted wastewater discharge in Guwahati based on future population projection, future water demand and wastewater discharge.

Table 7-16: Forecasted Wastewater Discharge in Guwahati

Year	Population	Water Demand (MLD)*	Wastewater Discharge (MLD)**
2021	1475651	232.90	186.32
2031	2024566	318.81	254.54
2045	3863812	606.06	484.48

Note: *Excluding 15% Water loss in distribution

** Considering 80% of the water consumption will be drained as wastewater

(Source: Compiled by Consultant)

7.1.2.3 Status of Wastewater Management as per MOUD Service Level

Benchmark:

Table 7-17: Wastewater management SLB

Indicators	GMPA
Coverage of Toilets	4708 (4697 units of individual HH latrine constructed under SBM; 11 units of community toilets constructed under SBM)
Coverage of wastewater network Services	No dedicated waster water network laid within GMPA
Collection efficiency of wastewater network	Not being monitored
Adequacy of Waste Water treatment Capacity	Presently there is no wastewater treatment plant available.
Quality of Wastewater Treatment	No STP no Monitoring
Extent of reuse and recycling of wastewater	No such Practices are happening
Extent of cost recovery in wastewater management	No such Practices are happening
Efficiency in redressal of Customer complains	No Customer feedback portal has been developed

7.1.2.4 Proposed Strategies

In a modern society, proper management of wastewater is a necessity, not an option. A wide range of communicable diseases can be spread through elements of the environment by human and animal waste products, if not disposed properly. The development of effective water and wastewater treatment methods has virtually eliminated major water borne epidemics in developed countries.

Developing countries like ours, where treated water is not available to a majority of the population, still experience epidemics like cholera and typhoid. It is also to be

mentioned that as per the report of the Planning Commission for the Tenth Five Year Plan, which emphasizes that all cities, towns and industrial areas should compulsorily have sewage treatment plants and are to be implemented in a time bound manner. Advanced waste water treatment process is currently being so developed that it will produce palatable water from domestic wastewater.

Recommendations

- For treatment of waste water generated from the planning area, a decentralized wastewater treatment system would be more appropriate. The centralized sewage treatment system appears inappropriate as it may end up with very huge sizes of sewers and various issues of conveyance in handling this huge quantity of wastewater.
- The treatment plants and sewers are to be so aligned as to reduce the number of crossings with railway tracks and National Highways of the area. The proximities of natural drains for treated effluent disposal, minimum obstructions for laying sewers, and the possibilities of acquiring land for sewage treatment plants (STPs) turns important in orienting and locating the plants.
- The possibilities of re-use of treated wastewater effluent for irrigation, gardening etc. should be looked into.
- The construction of treatment plants could be carried out in a phased manner on a modular/zonal basis in the planning area consistent with the future development/demand.

7.1.2.4 Proposal for STP

There should be underground sewerage connection to each households and from where the discharged wastewater should go to sewerage treatment plant before discharging it into the natural drains. While planning for the proposed sewerage system, consideration should be given to the natural drainage pattern. The sewerage system should be planned in such a way that there will be minimum pumping involved in collection and conveyance of sewage. New Sewerage Treatment Plant (STP) sites should be identified depending on considerations such as the quantum of environmentally suitable land, and availability of government land, capital and O&M cost of different options. While the underground sewerage is been planned and implement, the authority needs to make sure that each household in the region has a

septic tank installed and is being managed and is fully functioned. Water from commercial and industrial activities wastewater is being treated before discharging in the river.

Considering these guidelines, and the water flow direction, the Master Plan prefers to have the possible locations for the STP sites far off from the contiguous urban developable area. The possible suitable locations of individual site are as mentioned below,

Multipale decentralized loaction have been identified within planning area.

South Guwahati

1. On government land at Barsola Beel
2. On government land at Silsako beel
3. On government land near Pamohi river at Baragaon
4. On Barahmaputra riverbank at Dharapur
5. On government land at Basitha on river bank

North Guwahati

1. On Barahmaputra riverbank at Gandhmow village
2. On government land near Ashwaklanta at North Guwahati

7.1.3 Storm Water Drainage

7.1.3.1 Existing Scenario

Guwahati has humid subtropical climate, and the monsoons are recorded for 6-7 months throughout the year and average precipitation in the region scales unto 1,700-1,800 mm rainfall. Currently Guwahati metropolitan region lacks of proper storm water drainage facilities, and as a result, during monsoons the city frequently faces flood like situation; hence, it needs an immediate intervention in terms of infrastructural layout/design and implementation because Brahmaputra is a flooding river.

The river Brahmaputra as already mentioned is mainly responsible for carrying all the foul waters discharged by the city. Most of the storm water from the area south of the river Brahmaputra is carried away through the rivers Bharalu and Basistha flowing inside the city to Deepor bil situated in the south-west part of Greater Guwahati city and finally discharged to the river Brahmaputra through Khanjan river. A few other natural streams, which carry rain water from the city are Bahini and Mahabharalu.

In the north bank of the river Brahmaputra, the rain water from the North Guwahati Township is also discharged to river Brahmaputra directly or through Ghorajan river following the natural topography of the area.

On the easternmost side another low-lying area viz., Silsakao beel also receives considerable drainage and ultimately discharges into river Brahmaputra.

Guwahati does not have a proper sewer system, leading to untreated or semi-treated sewage being disposed in the natural storm water drains. A separate storm water and sewerage system is essential to save the population from calamity in the near future. Further, due to the unplanned and unauthorized development on the watershed areas, the slope has been modified leading to water logging. In addition to this, built-up on hilly areas have altered the slope tremendously. These developments have neglected the natural drainage and altered the sensitive local water systems in Guwahati, causing flooding.

However, only with the exception of a very small area of the city, there is no proper drainage system. There are a few pucca drains in the central part of the city by the side of the major roads. These do not function satisfactorily due to excessive siltation, which have resulted in clogging up of drains. Moreover, due to unplanned development of the city in the low-lying areas, the drainage system has also become

ineffective. This results in flooding of the city by river Brahmaputra and subsequent contamination of water in the wells. This in turn, exposes the city population to a large number of waters borne diseases. The following tables show the availability of storm water drains in GMDA

Table 7-18 Types of Drains in GMDA

Type of Drain	Length In Km	Percent to total
Open Pucca Type	550	30.35%
Closed Pucca Type	12	0.66%
Kutcha Type	1250	68.98%
Total	1812	100.00%

(Source: GMDA)

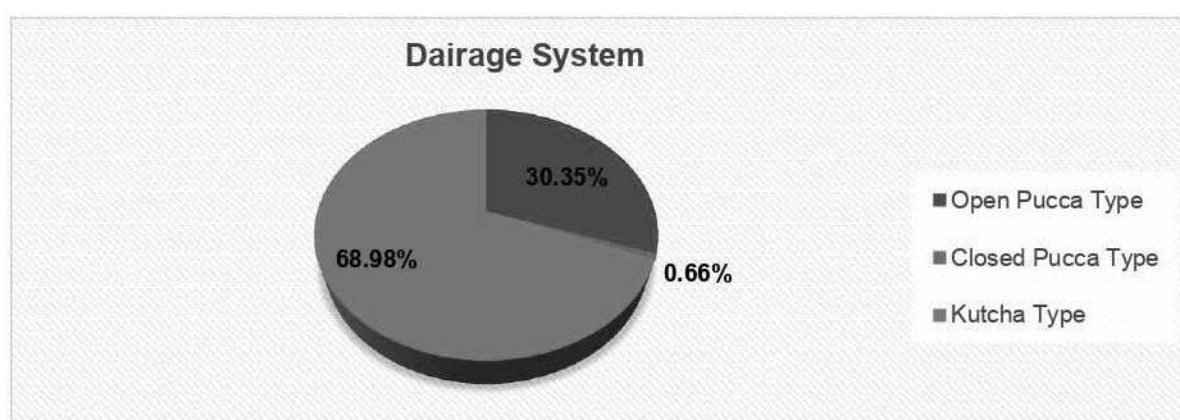


Figure 7-11: Percentage of Drains Within GMDA (source: GMDA)

The drainage system of Guwahati city depends heavily on the existing natural drains. The conditions of these channels are not very convincing as they are constantly covered with garbage, waste material and sewage. The water resource department had prepared a comprehensive plan for the clearing and management of these drain channels, which are like a lifeline of Guwahati City for the purpose of draining out water currently. The city doesn't have planned drainage system to take care of sewage or wastewater which is being generated, so these natural channels become even more important.

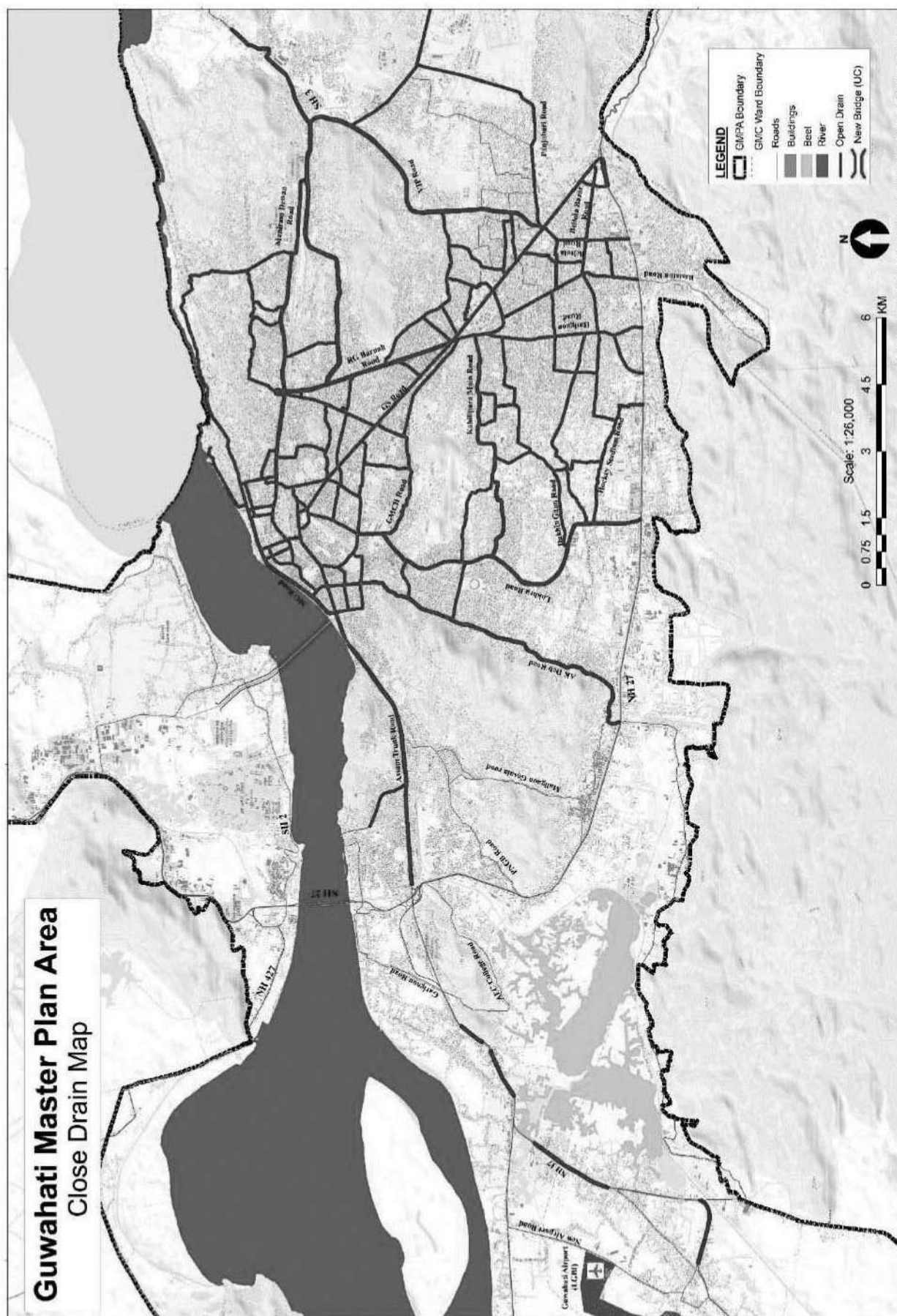


Figure 7-12: Drainage Network Map, Guwahati

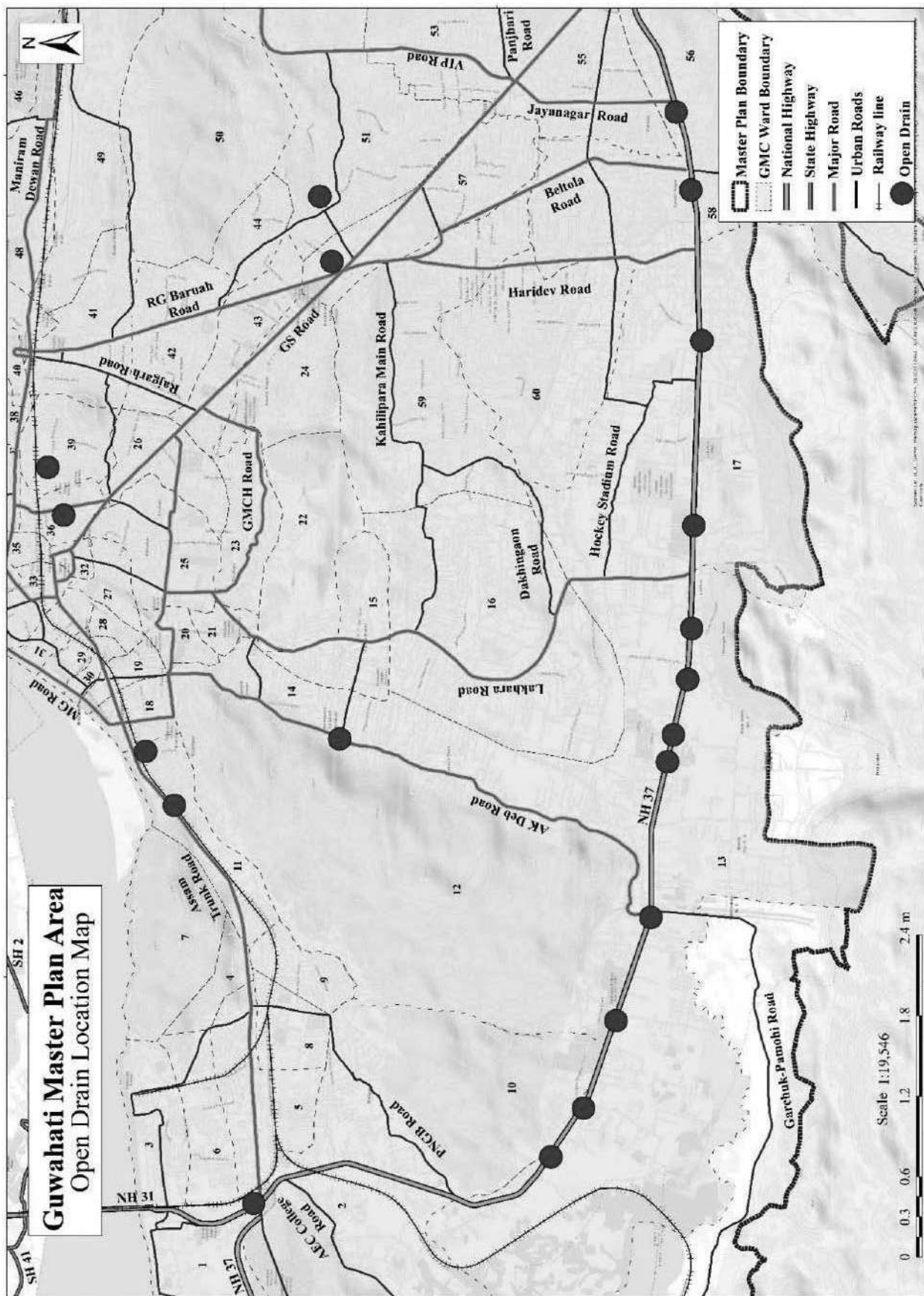


Figure 7-13: Open Drainage Channel Location in Guwahati

7.1.3.2 *Issues and Requirement*

Open Channel Area:

- Closed channel water drainages are observed on many streets within GMC area where some streets are under progress.
- Unhygienic condition due to open channel leads to spread of diseases.
- It also leads to high health risk due to illegal discharge of wastewaters and solid waste.
- Another issue includes foul odour source establishment and becomes a breeding ground for insects and pests.
- Regular cleaning service is not done to remove solids from the open channel area which increases the chances of blockages which can cause spill-over and flooding.



Figure 7-14: Open Storm Water Drainage Carrying Mixed-waste Water and Solid Wastes at Residential Area



Figure 7-15: Solid Waste Dumping on Storm water Drains at Commercial Areas

The existing drain system of the city consists of:

- Bharalu Basin (catchment area=100 sq. km)
- Silsako Beel Basin (Catchment area = 92 sq. Km)
- Deepar Beel Basin (Catchment area= 144 sq.km)
- Kalmoni Basin (Catchment area= 66.5 sq.km)
- Fore shore Basin

The existing natural drain channels are:

- Bharalu-Bahini river system
- Mora Bharalu River
- River Basistha
- Lakhimijan Channel
- Bondajan Channel
- Khanajan River
- Kalmoni River

There are a number of sub projects listed within the entire flood management plan.

i) Bahini Bondajan Flood Water Evacuation Project- the main features of this project are-

- Construction of RCC drain of length 700 metre from Rukminigaon to VIP road.
- Re-sectioning of VIP roadside drain to a capacity of 15 cumec discharge up to Silsako Beel and Re-sectioning of existing channel from Silsako Beel to Bondajan sluice gate
- Construction of additional sluice gate at Bonda having five shutters opening to arrive at combined capacity of 80 cumec discharge.
- Installation of high-capacity pumping station at Bondajan to facilitate dewatering when the sluice gate is closed.

ii) Providing of Pumping Stations at different locations to relieve drainage congestion

- Renovation of Bharalumukh pumping station by installing 6 nos. Of new high discharge pump
- Installation of high-capacity pumps to throw discharge of khanajan during closure of Khanajan sluice.
- Procurement and installation of trolley mounted pump sets for dewatering of storm water at waterlogged areas of Guwahati City.

iii) Defining boundaries of the natural channels

- Construction of flood walls on both bank of river Mora Bharalu.
- Construction of flood walls on both banks of river Bahini.
- Construction of flood walls along both banks of river Bharalu.
- Re-sectioning of Pamohi channel from Mora Bharalu outfall point at N.H. to Deepor Beel

iv) Improvement of sluice gate over Kalbhog channel with proper pumping facilities including flood walls along both bank of Kalbhog channel from Kalbhog sluice to its outfall (for augmentation of flood at LGBI Airport and its adjoining areas.

- Constructon of new channel from backside of new terminal of LGBI Airport to Kalbhog channel and from Kalbhog channel to existing drainage channel at Dakhala and then Kuldung to end of Dora Beel towards river Kulsi.
- Construction of new channel from Batahi bridge near Dekapara towards Padma Lake to Kalbhog channel to meet the main drainage channel as mentioned above.
- Improvement of existing drainage channel from Dakhala to Dora Beel which has its outflow to the river Kulsi.

- Improvement of Kalbhog channel and the channel coming from Dharapur through new terminal towards Agchia.
- Construction of Hume pipe sluice at suitable location to drain the run-off from sub-catchment area of surrounding areas.

(Urban flood in Guwahati, Assam state disaster Management Authority, July 2014)

7.1.3.3 Status of Storm Water Drainage as per MOUD Service Level

Benchmark:

Table 7-19: Storm water Drainage SLB

Indicators	GMPA
Coverage of Closed Storm water drainage network Services	46% Closed drain coverage
Incidence of water logging/ Flooding	Every year during Monsoon

(Source: Compiled by Consultant)

7.1.3.4 Proposed Strategies

A separate storm water drainage network has been proposed in the development area for the collection and safe disposal of storm water during rainfall. The design criteria to be followed for design of Storm Water Drainage network are broadly based on the recommendations as laid down in the CPHEEO Manual of Sewerage and Sewage Treatment, Ministry of Urban Development, Government of India and as per provisions laid down in the relevant I.S. Codes and Consultants' past experience in related field.

- Rectification of slope and width of drains shall be done, wherever required.
- Provision of new storm water drainage network as per phase wise requirements worked out considering key parameters of precipitation intensity, catchment delineation, percolation characteristics and surface runoff.
- Existing drains which can be used as storm water drains, need to be upgraded based on engineering aspects & runoff calculation.

7.1.3.3 Recommendations

- The lack of proper sanitation and solid waste management, combined with indiscriminate dumping of solid waste in the drains reduces the carrying capacity of these natural drains. The implementation of a systematic solid waste and wastewater collection and treatment system is a necessary prerequisite for proper drainage of the area.
- The natural drains have been encroached upon and are almost in dilapidated state. Also, at many reaches the drain sidewalls are found to be damaged. The section of the drain is also irregular and less adequate at many locations. Proper gradient is not maintained at several stretches on its reach and the hydraulic

parameters are also not uniform. Also, no definite drain section is maintained in many reaches. So, proper maintenance and management of the existing natural drains turns important. This necessitates a proper evaluation of the existing natural drainage system.

- Over the years the River Brahmaputra has progressively silted up due to which the flood water flows at ever higher levels than the water levels in this main drain.
- The natural depressions and ponds, which were instrumental in preventing excess storm run-off, are getting filled up at a rapid rate due to urbanization. This may further aggravate the existing problem of water logging. It is necessary that 'natural sinks' be retained as such as, they are instrumental in controlling the water logging of the area.
- An organized drainage system is invariably associated with the implementation of a systematic solid waste and wastewater collection and treatment system.
- Periodic de-silting of the existing storm water drains should be done.
- Perimeter protection of all the major drains should be checked before every rainy season.
- Overall, the preparation and implementation of a master drainage plan appears essential for Guwahati Planning Area
- All roads of the town/city should have side-drains, which will serve as minor or tertiary drains
- Existing drains which can be used as storm water drains, need to be upgraded based on engineering aspects & runoff calculation
- A plan for the drainage of some of these areas has been prepared. The implementation of a master drainage plan for these areas appears very essential

7.1.4 Solid Waste Management

Solid Waste Management is one of the major challenges the Guwahati city is facing. The city does not have a systematic garbage collection and disposal system, which is affecting the living environment in the city. Citizens have a habit of throwing garbage on streets, into the open drains, in the backyard, and in the open spaces. With the growing solid waste in the city, the living environment in Guwahati city is worsening; with some environmental problems like water logging, dust pollution has also cropped up. Garbage thrown by the citizens into the open drains is considered as major responsible for clogging of drain and artificial water logging.

The entire GMPA is acquiring 328 sq.km. this chapter provides the description of Solid Waste Management System of this area, with detailed analysis of Municipal Solid Waste Management. According to Census 2011, the population within GMPA was 11,41,699 having household number 2,71,225, considering 500 gm per capita waste generation per day, the waste generation sums up to 570 Tons per Day (TPD) domestic waste. It is estimated that within GMPA population will increase at a rate of 33.22% which gives a number of 14,75,651, having household 3,35,375 generating 738 TPD domestic waste. The population in urban area is higher compared to the outer and rural region. Withing GMC area the present estimated population is about 12,82,046 having household number 3,05,250 and from GMC area approx. 641 TPD is estimated domestic waste generation.

7.1.4.1 Existing Scenario of SWM system of Guwahati

The rapid population growth, growing urbanization and proliferation of slums are all contributing to the solid waste generation. As per Gol data, Guwahati city generates approx. around 800 tons of solid waste per day (TPD), 575 TPD is being collected from GMC Wards including both primary and secondary waste. These wastes being disposed in an open dumpsite at Boragaon, thus posing severe ecological imbalances with respect to land, water, and air pollution. Presently GMC, with the help of urban local bodies (ULBs) take care of solid waste management activities within their respective jurisdiction.

In North Guwahati average waste generation in a day is 2TPD out of which 0.2TPD is being collected every day. According to North-Guwahati Town Committee, 50% of the Households in North Guwahati are getting Door to Door waste collection service.

Presently 10 staffs are working in waste management and for waste transportation total 11 vehicles are there.

7.1.4.2 Main Features of GMC Waste Management

Table 7-20 Details of GMC Jurisdiction

Particulars	Description
Area	216.79 sq.km
Population (Census 2011)	9,63,429
Population 2021 (Estimated)	1282046
No. of households (Census 2011)	230769
No. of households 2021 (Estimated)	305250
No. of commercial establishments	89000
Number of Industrial Establishment	1331 (Mixed of all types)
Municipal divisions	6
Wards	31
Population Density (per sq.km)	579
Daily Dry Waste Generation	322
At- Source Segregation	40%
Coverage of Door-to-Door Collection	100%
Existing Transfer Station	4 (4 new proposed)
Manpower	260

(Source: GMC)

Table 7-21: Details of Ward Wise Waste Generation in GMC

Ward No.	Zone Name	Total No. of households	Waste Quantity (TPD)
1	Division – I	10153	7.46
2	Division – I	8158	7.46
3	Division – I	7543	9.95
4	Division – I	7483	6.21
5	Division – I	10835	9.95
6	Division – VI	6820	12.44
7	Division – I	11451	12.44
8	Division – I	8846	18.66
9	Division – IV	3011	31.11
10	Division – II	5719	31.11
11	Division – II	5504	31.11
12	Division – II	5102	24.88
13	Division – II	7235	14.92
14	Division – IV	8788	24.88
15	Division – IV	7659	18.66
16	Division – VI	7987	18.66
17	Division – VI	7598	18.66
18	Division – IV	9958	24.88
19	Division – III	7460	18.66

20	Division – III	8073	18.66
21	Division – III	7705	24.88
22	Division – III	7959	18.66
23	Division – III	7270	24.88
24	Division – III	8642	18.66
25	Division – III	9722	14.92
26	Division – V	9018	18.66
27	Division – VI	7836	18.66
28	Division – V	6989	18.66
29	Division – V	7532	18.66
30	Division – V	8905	18.66
31	Division – V	8977	18.66
Total		245938	575.00

(Source: GMC)

The solid waste management system presently adopted by GMC is shown in the figure:

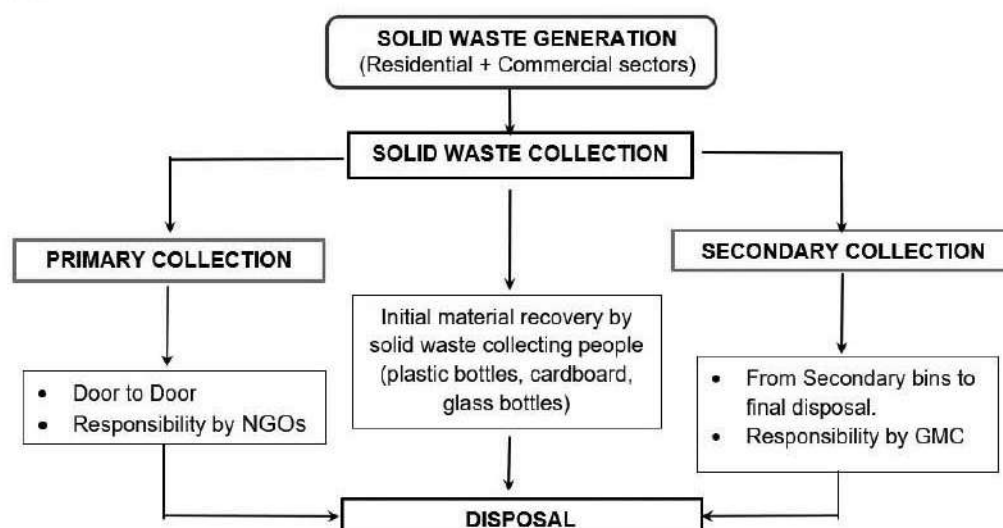


Figure 7-16: Project management plant at Guwahati